Outer Continental Shelf Oil and Gas Information Program

Gulf of Mexico Summary Report 3

Prepared for the U.S. Department of the Interior, Minerals Management Service,
in cooperation with the U.S. Geological Survey

U.S. Geological Survey Open-File Report 82-242

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PUBLICATION DATES OF OCSIP DOCUMENTS

Summary Reports

North Atlantic		Mid-Atlantic		South Atlantic	
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				Update	3/83

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Outer Continental Shelf Oil and Gas Information Program

Gulf of Mexico Summary Report 3

August 1982

A revision of Outer Continental Shelf Oil and Gas Activities in the Gulf of Mexico and their Onshore Impacts: Gulf of Mexico Summary Report 2, August 1981

by Kenneth J. Havran, Jeffrey D. Wiese, Karen M. Collins, and Frederick N. Kurz

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U.S. Geological Survey Open-File Report 82-242

Note to Readers

On January 19, 1982, Secretary of the Interior James G. Watt issued Secretarial Order No. 3071 establishing a Minerals Management Board and a Minerals Management Service (MMS) that would be under the supervision of the Under Secretary. On May 10, 1982, Secretary Watt signed an amendment to Secretarial Order No. 3071. In accordance with the amended order, the Minerals Management Board will continue to be chaired by the Under Secretary, with other members of the Board being the Assistant Secretaries for Energy and Minerals, Land and Water Resources, Indian Affairs, and Policy, Budget, and Administration. The Board will supervise and oversee MMS operations.

The Minerals Management Service will implement new policy and guidance procedures developed by the Minerals Management Board and will be responsible for exercising the following:

- All functions carried out previously by the former Conservation Division of the U.S. Geological Survey (USGS);

- All functions in direct support of the Outer Continental Shelf Program, including but not limited to the following: all functions of the Office of OCS Program Coordination; all functions related to the management of offshore energy and minerals administered by the Bureau of Land Management (BLM); all functions that support the OCS program in the Geologic Division and the Office of the Assistant Director for Resource Programs of the U.S. Geological Survey; oil spill trajectory analysis functions of the Office of Earth Science Applications, U.S. Geological Survey; all functions of the Office of Policy Analysis relating to scheduling the sale of leases of OCS lands; and all functions relating to the OCS program transferred from the Department of Energy.

Until further notice, the Minerals Management Service will continue to use administrative support services provided by the U.S. Geological Survey and the Bureau of Land Management, and the Office of OCS Information will continue to use the USGS open-file report numbering system for summary reports and indexes. References to the U.S. Geological Survey and the Bureau of Land Management remain in this document. Future Office of OCS Information publications will report changes in organization as they occur.

Acknowledgments

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The Field Draft Review Committee improved the accuracy of the report by providing information and comments. The members of that committee were Syd Verinder, Charley Guice, Charles E. Knight, Floyd Bryan, Brent Smith, John Ward, John Knipmeyer, and Ralph Melancon from the Minerals Management Service, Metairie, Louisiana. Dave Nystrom and Mike Carter represented the Minerals Management Service from Reston, Virginia. Doug Slitor supervised the project for the Minerals Management Service. Mary Davis served as editorial coordinator for the Minerals Management Service. The photographs for the report were supplied by Doug Slitor from the Minerals Management Service and Jeffrey Wiese from Rogers, Golden & Halpern.

At Rogers, Golden & Halpern, Fritts Golden provided overall project management. Sandy Dechert designed the report, and Richard Barrett edited and supervised its production. Mary Ann Collignon assisted in the preparation of appendix A. Laurie Seniuk, Kim Tomlinson, and Joan Santucci-McCusker executed the graphics. Gene Gilroy, Sue McGuire, Valerie Smith, Tanya Coble, and Matthew McClain provided editorial, graphics, and technical support.

English-Metric Conversion

(The following table gives the factors used to convert English units to metric units.)

Multiply English units	by	to obtain metric units
feet	0.3048	meters
miles	1.6090	kilometers
acres	0.4046	hectares
barrels	0.1589	cubic meters
cubic feet	0.0283	cubic meters

Abbreviations and Acronyms

APD - application for permit to drill
API - American Petroleum Institute
bcf - billion cubic feet
BLM - Bureau of Land Management, Department of the Interior
BOE - barrels of oil equivalent
CEIP - Coastal Energy Impact Program
CFR - Code of Federal Regulations
COE - U.S. Army Corps of Engineers
CTGS - Central Texas Gathering System
CZM - Coastal Zone Management
CZMA - Coastal Zone Management Act
DEIS - draft environmental impact statement
DOI - Department of the Interior
EIS - environmental impact statement
EPA - Environmental Protection Agency
FERC - Federal Energy Regulatory Commission
FRRE - Field and Reservoir Reserve Estimate
FY - fiscal year
GCTT - Gulf Coast Transshipment Terminal
HIOS - High Island Offshore (pipeline) System
H.R. - House Representative
IPP - Intergovernmental Planning Program for OCS Oil and Gas Leasing, Transportation, and Related Facilities
km - kilometers
km2 - square kilometers
LCRP - Louisiana Coastal Resources Program
LNG - liquified natural gas
LOOP - Louisiana Offshore Oil Port
m - meters
m2 - square meters
m3 - cubic meters
MAFLA - Mississippi, Alabama, and Florida
MMS - Minerals Management Service, Department of the Interior
NEPA - National Environmental Policy Act of 1969
NOAA - National Oceanic and Atmospheric Administration
NPDES - National Pollutant Discharge Elimination System
OCS - Outer Continental Shelf
OCSIP - Outer Continental Shelf Information Program
Pelco - Pelican Terminal Company
POD/P - plan of development/production
POE - plan of exploration
PWSA - Ports and Waterways Safety Act
RSP - Regional Environmental Studies Program
RTMP - Regional Transportation Management Plan
RTWG - Regional Technical Working Group
S. - Senate
SALM - single anchor-leg mooring
SLA - Submerged Lands Act
SMSA - Standard Metropolitan Statistical Area
SOS - Seagull Offshore System
TOPS - Tarpon Offshore Pipeline System
UNCLOS - U.N. Conference on Law of the Sea
USGS - U.S. Geological Survey, Department of the Interior
VLCC - very large crude carrier

Abstract

Now, and for the near future, the Gulf of Mexico will remain the most developed Outer Continental Shelf (OCS) region in the United States and the world. Virtually all production from the U.S. OCS emanates from the Gulf of Mexico. In calendar year 1981, for the two primary categories of hydrocarbons produced from the OCS, oil/condensate and gas, Gulf production accounted for over 94 and 99 percent, respectively. Oil production for 1981 was 0.27 billion barrels, and gas production was 4.84 trillion cubic feet. Although most of the shallow-water areas of the Gulf of Mexico Continental Shelf have been explored, considerable amounts of hydrocarbons may yet be discovered in deepwater locations. Industry has been developing the technology to explore deepwater areas, and interest in these portions of the Gulf is increasing.

As of December 1981, the total of all identified oil and gas fields in the Gulf of Mexico OCS increased to 505 from 482 at the end of the previous year; this net increase of 23 fields discovered in 1981 compares to net increases of 50 in 1980, 51 in 1979, and 25 in 1978. The number of active fields increased from 466 in 1981, and fields for which reserve estimates have been made increased from 419 to 445. As of January 1982, 19,736 offshore oil and gas wells had been drilled in the Gulf of Mexico OCS; most of the wells (17,257) are off the coast of Louisiana. Currently, there are 2,027 active oil and gas leases in the Gulf of Mexico; 1,200 of them are producing leases.

The Department of the Interior's 5-year OCS oil and gas leasing schedule projects 2 to 3 Gulf of Mexico lease sales per year through 1987, for a total of 12 offerings, and starting in 1983, the Gulf will be divided into three planning areas. Resource estimates issued for the following Gulf of Mexico lease sales are as follows: Lease Sale 67--75.16 million barrels of oil and 1.03 trillion cubic feet of gas; Lease Sale 69--48.24 million barrels of oil and .785 trillion cubic feet of gas; Lease Sale 72--97 million barrels of oil and 1.04 trillion cubic feet of gas; Lease Sale 74--29 million barrels of oil and .525 trillion cubic feet of gas; and Lease Sale 79--123 million barrels of oil and .157 trillion cubic feet of gas.

Since 1972, oil production in the Gulf of Mexico has declined each year, and gas production, thought to have reached its peak in 1981, is also expected to begin a noticeable decline. To date, most of the oil and gas discovered in the Gulf has occurred on the Texas-Louisiana Shelf, but in the future, oil and gas exploration is likely to include a number of areas where previous leasing has not been extensive. The West Florida Shelf, especially the area off the coast of southwest Florida and the deepwater areas southeast of the Mississippi River Delta, are potential areas for future exploration. As production begins to decline from mature fields, smaller fields will become economically producible, and implementation of secondary and tertiary recovery techniques will make it possible to extract more oil and gas from reservoirs than was possible previously.

Each year, hundreds of miles of pipelines are added to the existing network in the Gulf of Mexico. Recently, there have been a number of proposals for deepwater ports and transshipment terminals as well as projects including the deepening or widening of existing conventional ports. The process of transportation planning in the Gulf of Mexico is done by industry and government through the Intergovernmental Planning Program and its Regional Technical Working Group.

The Gulf Coast region is an area of significant onshore oil and gas activity, with

many cities and towns offering a wide range of services and supplies to onshore and offshore oil operators and their ancillary industries. While the western and central Gulf oil and gas support infrastructure is quite extensive and complex, the support facilities in the eastern Gulf are still in the early stages of development. In the likely event of a decline in Gulf OCS production, imported oil may be substituted for dwindling domestic stocks at Gulf Coast refineries. Planners must consider impacts generated by changes in oil and gas productivity and focus on finding alternative uses for facilities and alternative employment for workers.

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Introduction

This report, **Gulf of Mexico Summary Report 3,** is the latest in a series of annual reports summarizing current oil and gas activities in the Gulf of Mexico Outer Continental Shelf (OCS) and their onshore impacts. The previous report, **Gulf of Mexico Summary Report 2** (USGS Open-File Report 81-620), was published in August 1981. Copies of that report are still available and can be ordered from the Office of OCS Information; the address appears on the inside front cover of this document.

An effort has been made not to duplicate material published in earlier reports. However, it has been necessary in some instances to repeat information in order to lay the groundwork for a discussion of current activities or events.

These summary reports are designed to offer State, regional, and local planners current information that may be useful in anticipating and planning for onshore impacts of offshore oil- and gas-related activities. This is achieved by describing the type and level of recent and ongoing OCS operations, as well as by projecting near-term (approximately 6 months) OCS events.

Information presented in a summary report is a synthesis of information obtained through field interviews with Federal, State, and local government representatives, and spokespersons from various industry and special-interest groups, coupled with research and review of government and industry studies and publications.

The Gulf of Mexico Outer Continental Shelf is a vast region, with great proven hydrocarbon resources. The major portion of U.S. offshore production has come from this region. Although most of the shallow-water areas of the shelf have been explored, considerable amounts of hydrocarbons may yet be discovered in deepwater locations. Industry has been developing the technology to explore deepwater areas, and interest in these portions of the Gulf is increasing. Until discoveries are made in deep water, however, the resource potential of this frontier will remain unknown.

The Gulf Coast region is also an area of significant onshore oil and gas activity. Gulf Coast hydrocarbon production began on land many years prior to offshore exploration. For this reason, an extensive network of onshore support industries exists to service both the onshore and offshore oil and gas industries.

Houston, Texas, and New Orleans, Louisiana, are capital cities for the oil industry. In addition to these major metropolitan areas, many smaller towns have grown up around the oil industry. In fact, many of these towns owe their existence to oil and gas. These towns offer a wide range of services and supplies to onshore and offshore oil operators and their ancillary industries.

Issues surrounding this regionwide dependency on the oil and gas industry should be addressed. For example, concern has been expressed for the fate of both small and large "oil towns" when a decline in domestic production occurs.

Other issues of current interest are those of conflicting uses on the OCS and the continual loss of marshes and wetlands as a result of dredge and fill and pipelaying associated with oil and gas operations. These issues will be discussed in appendix B of this report. Other topics of interest such as OCS revenue sharing, the status of State Coastal Zone Management Programs, and the municipal annexation of tidelands are addressed also.

The first chapter of the initial **Gulf of Mexico Summary Report** (USGS Open-File Report 80-864) presented, along with a corresponding appendix, a detailed discussion of the geology of the Gulf of Mexico Outer Continental Shelf. In this and succeeding reports, only new or updated geological and geophysical information on the Gulf of Mexico will be included. Resource and reserve estimates, however, are a standard feature of the summary report, and the latest available government estimates will appear in this and future reports.

Chapter 2 provides current information on exploration, development, and production, including specific data on OCS Lease Sales 66 and 67 and pre-lease information on Lease Sales 69, 72, 74, and 79 scheduled for the near future. The discussion of specific lease sales is followed by an analysis of current events and a projection of trends in exploration, development, and production.

Transportation elements, such as pipelines, vessels, deepwater ports, and transshipment terminals, are discussed in chapter 3. The current status of the Department of the Interior's Gulf Coast Regional Transportation Management Plan, along with related activities of the Intergovernmental Planning Program (IPP) and the Regional Technical Working Group (RTWG) of the National OCS Advisory Board are also given.

Chapter 4 contains a regional assessment of ongoing or proposed construction of major nearshore and onshore OCS-related facilities. Chapter 4 is followed by a compendium of OCS-related studies presented as appendix A.

Additional appendixes review OCS-related coastal issues, current oil spill response measures, and regional planning agencies and commissions in the Gulf of Mexico. A glossary following the appendixes contains definitions of geologic, industry-specific, and other special terms used in this report. In the pocket of the back cover of this revised summary report is a series of plates showing OCS activities in the region to supplement the text.

The pace of development of oil and gas resources on the Gulf of Mexico OCS depends, in large part, on the government's OCS oil and gas leasing program. Pursuant to section 18 of the Outer Continental Shelf Lands Act Amendments of 1978, the Secretary of the Interior annually reviews and periodically revises the OCS oil and gas leasing program. Revisions to the program are currently under way to streamline lease sale procedures, offer areas of high potential sooner, and offer more areas for leasing.

The final 5-year leasing schedule (July 1982) was approved on July 21, 1982. Under this schedule, 12 offerings in the Gulf of Mexico have been proposed. Starting in 1983, the Gulf will be divided into three planning areas. In 1983 and 1985, each of the planning areas will be offered for lease. In 1984 and 1986, only the central and western Gulf planning areas are scheduled to be offered. The schedule for 1987 only goes until June, and only one planning area is scheduled during that period. According to the July 1982 final 5-year leasing schedule, the following lease sales will be held in the Gulf of Mexico:

- Lease Sale 69--October 1982;
- Lease Sale 72, Central Gulf--May 1983;
- Lease Sale 74, Western Gulf--August 1983;
- Lease Sale 79, Eastern gulf--November 1983;
- Lease Sale 81, Central Gulf--April 1984;
- Lease Sale 84, Western Gulf--July 1984;
- Lease Sale 98, Central Gulf--May 1985;
- Lease Sale 102, Western Gulf--August 1985;
- Lease Sale 94, Eastern Gulf--November 1985;
- Lease Sale 104, Central Gulf--April 1986;

- Lease Sale 105, Eastern Gulf--July 1986; and

- Lease Sale 110, Central Gulf--April 1987 (DOI, 1982b).

Based on the number of lease sales projected, the Office of OCS Information will revise the summary report annually. To receive summary report revisions, one should return the postcard attached to the back cover.

The Office of OCS Information will answer questions on data appearing in this report. For further information concerning the leasing schedule, contact Michele Tetley, OCS Program Coordination Officer, Offshore Leasing Management Division, at (202) 343-9314.

1. Offshore Oil and Gas Resources of the Gulf of Mexico Region

This chapter summarizes the geology of the Outer Continental Shelf (OCS) in the Gulf of Mexico Region. The area as defined for this report extends from the United States-Mexico border, on the Gulf of Mexico, to the Florida Keys. **Plate 1**, found at the back of this report, shows the Gulf of Mexico OCS Region. Additional information about the geology of this region is contained in previous editions of this report (USGS Open-File Reports 80-864 and 81-620). Also contained in this chapter are the most recent oil and gas resource and reserve estimates for the Gulf of Mexico Region.

GEOLOGIC ASPECTS OF THE GULF OF MEXICO REGION

The Outer Continental Shelf of the Gulf of Mexico is a major oil- and gas-producing region of the United States, and extensive exploration continues in the area. Within the past 30 years, there has been a natural progression from onshore to offshore development. As drilling technology has improved, exploration has focused on the seaward portions of the Continental Shelf and the upper portions of the Continental Slope.

The Continental Shelf within the Gulf of Mexico can be characterized as an extensive plain that has a gentle seaward slope of less than 1 degree. Relief on the shelf is generally low, due mostly to the effects of sedimentation and the planation of waves and bottom currents. However, relief on a localized scale in association with coral reefs or faults has been observed to be as much as 60 feet (18 m). In areal extent, the shelf varies in width from a minimum of 12 miles (19 km) off the Mississippi River Delta to a maximum of 140 miles (225 km) off Crystal River, Florida.

The Continental Slope is a relatively steep geologic feature that lies between the shelf and the abyssal ocean floor. The gradient of the slope ranges from 2 degrees on the De Soto Slope to more than 45 degrees in certain limited sections of the West Florida Escarpment (Bergantino, 1971). Figure 1 identifies the principal subsea features including the nine physiographic provinces of the Gulf.

Physiographically, the northern Gulf of Mexico may be divided into nine distinct provinces (Bergantino, 1971). These nine provinces are the West Florida Shelf, the West Florida Terrace, the South Florida Slope, the West Florida Slope and Escarpment, the Mississippi-Alabama Shelf, the De Soto Slope, the Upper Mississippi Fan, the Texas-Louisiana Shelf, and the Texas-Louisiana Slope and Plateau.

The West Florida Shelf is underlain by approximately 15,000 feet (4,572 m) of predominantly carbonate sediment of post-Cretaceous age (Antoine and Hardin, 1965). These sediments are primarily either horizontal or dip slightly seaward in attitude. In general, the surface of the shelf exhibits very little relief, although local relief of up to 18 feet (5.5 m) is associated with some areas of poorly developed karst topography. The West Florida Shelf, together with the West Florida Terrace, the South Florida Slope, and the West Florida Slope and Escarpment form a geologic unit that is commonly referred to as the Florida Carbonate Platform.

The West Florida Terrace is located west of the northern portion of the West Florida Shelf. This topographically smooth province possesses a gradient that gradually steepens seaward to reach a maximum of 6 degrees at the West Florida Escarpment. The carbonate sediments that underlie this province have a slightly greater seaward inclination than those found under the shelf.

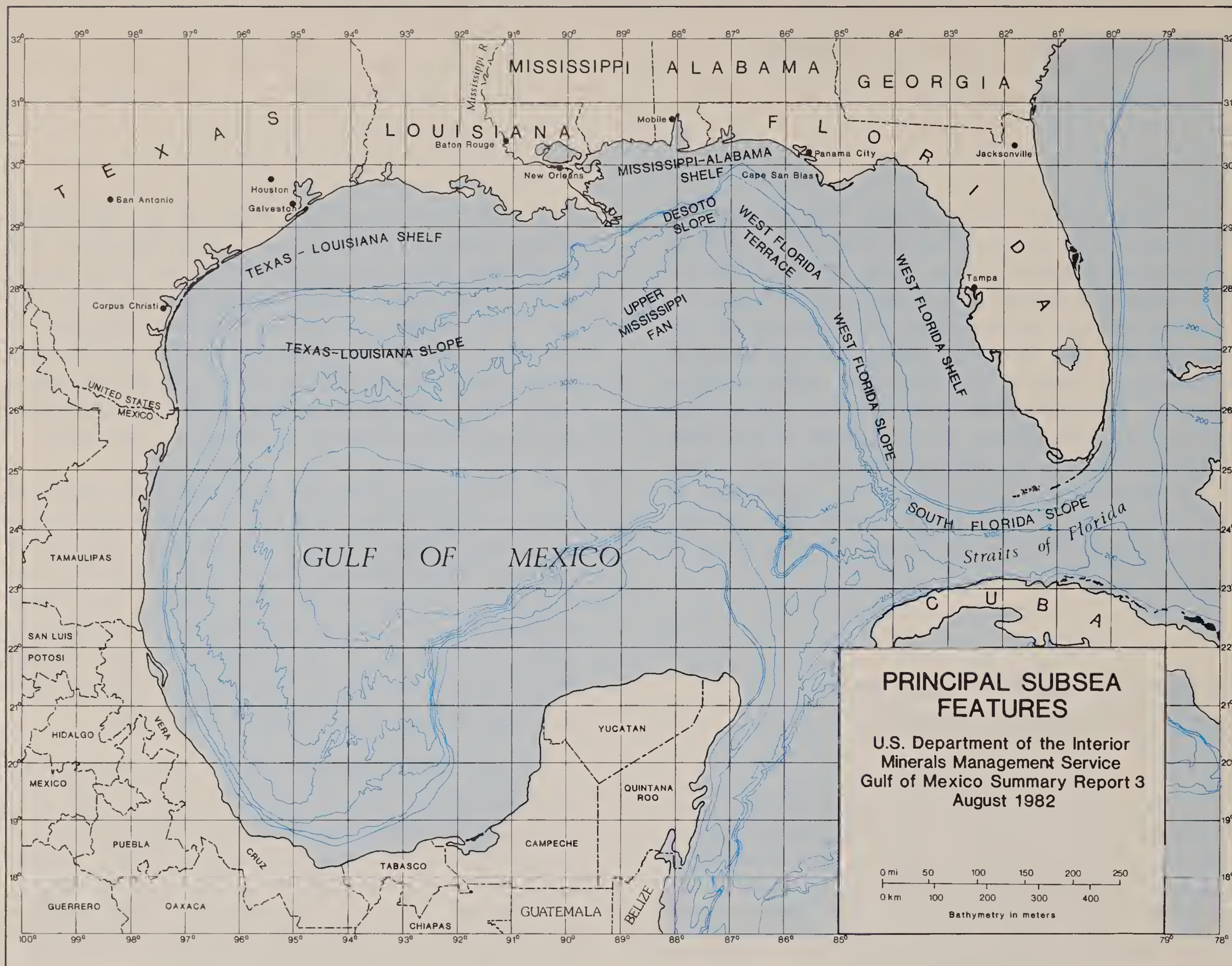


FIGURE 1.--Principal subsea features of the Gulf of Mexico. (Adapted from Havran and Collins, 1980, by Rogers, Golden & Halpern.)

Located immediately south of the West Florida Shelf, the South Florida Slope is a moderately steep portion of the Continental Slope that contains two rather large and well-defined terraces. The surface of one of these terraces, the Pourtales Terrace, is pock-marked by a number of deep sinkholes. In the western section of this province, the lower portions of the slope are incised with a number of large valleys.

The West Florida Slope and Escarpment represents the western boundary of the Florida Carbonate Platform. Varying in width from 5 to 20 miles (8.0-32 km), this province can be physiographically divided into two sections. North of lat 26 deg 50 min N., the province is composed of a prominent escarpment that lacks any major surficial feature. South of lat 26 deg 50 min N., the escarpment is topped by a topographically irregular slope. The West Florida Escarpment was built by shelf-edge reef complexes during the early Cretaceous age (BLM, New Orleans OCS Office, 1981a).

Except for a few topographic interruptions, the surface of the Mississippi-Alabama Shelf is uniform. Underlain by the eastern

portion of the Gulf Coast geosyncline, the Mississippi-Alabama Shelf is situated on a thick accumulation of predominantly clastic sediment. Approximately 40,000 feet (12,192 m) of post middle-Jurassic sediment is accumulated beneath the western portion of this province, in the vicinity of the Mississippi Delta.

The DeSoto Slope, located seaward of the Mississippi-Alabama Shelf, is typified by a gentle gradient. The topography of the slope is broken in several places by the surficial expression of underlying diapirs. A major physiographic feature of this province is the De Soto Canyon. Located on the southeastern border of the province, the canyon measures 1.5 to 2.0 miles (2.4-3.2 km) wide by about 20 miles (32 km) long and has a maximum relief of 600 feet (183 m) (Bergantino, 1971).

The Upper Mississippi Fan province includes only the upper portions of a very large and broad sedimentary apron that extends from the upper Continental Slope near the Mississippi Delta to the abyssal depths of the Gulf. Numerous topographic irregularities attributable to diapirism and sediment movement can be found on the fan. Local relief averages approximately 120 feet (37 m) but may be as great as 600 feet (183 m). The most significant surface feature of the province is the Mississippi Trough. Local relief within the trough can exceed 1,320 feet (402 m).

Topographically, the surface of the Texas-Louisiana Shelf is generally quite smooth. However, like most other non-carbonate Continental Margin locations of the Gulf of Mexico, the surface expression of diapirs does cause areas of localized relief. Structurally, the dominant feature of this province is the Gulf Coast geosyncline. Sediment accumulations in portions of this basin approach a maximum thickness of 60,000 feet (18,288 m). The thickest accumulations of sediments in the basin occur along the present coastline from southernmost Texas to the Mississippi River Delta (Havran and Collins, 1980). The landward limit of the basin lies approximately 200 miles (322 km) north of the present shoreline, and the southern limit of the basin is generally considered to be located above the base of the Continental Slope.

In general, the gross shape of the Texas-Louisiana Slope is steplike, consisting of moderate upper- and lower-slope gradients and a plateau-like middle slope region. The average gradient of the slope is less than 1 degree, although localized slopes greater than 12 degrees are common (Powers, 1981). Topographically, this province contains numerous complex hillocks, closed basins, and submarine canyons formed by diapiric intrusion and uplift. The Sigsbee Escarpment forms the southern edge of the plateau from Alaminos Canyon in the west to the Mississippi Fan. This escarpment is marked by little more than a minor steepening of slope gradient between the middle slope plateau and the Continental Rise. The Sigsbee Escarpment appears to have been formed by a basinward extrusion of salt along a single front.

Hydrocarbon-bearing formations in the Gulf of Mexico are primarily associated with vertical salt movement that has resulted in the formation of salt domes. This process, known as salt tectonism, frequently results in the formation of structural and stratigraphic traps where oil and gas can be found, if other favorable conditions for their accumulation are also present. Hydrocarbons in the Gulf are also associated with other types of structural traps, for example, growth faults.

In the Gulf of Mexico OCS, 505 oil and gas fields have been identified (Hewitt and others, 1982). To date, most of these oil and gas discoveries have occurred primarily on the Texas-Louisiana Shelf. Hydrocarbons produced from this province are extracted from the Gulf Coast geosyncline. Within this basin, the main offshore hydrocarbon-bearing intervals are of Miocene, Pliocene, and Pleistocene age.

In the future, oil and gas exploration in the Gulf of Mexico OCS is likely to include a number of areas where leasing, to date, has not been extensive. The West Florida Shelf, especially the areas off the coast of southwest Florida, and the deepwater areas southeast of the Mississippi River Delta are potential areas for future exploration. Blocks in the Charlotte Harbor Area were leased in Sales 66 and 67 and are being offered in Lease Sale 69. The Charlotte Harbor Area is located on the West

Florida Shelf off the coast of southwest Florida, just north of lat 26 deg N. (shown on **plate 1**). Blocks in the Howell Hook and Pulley Ridge Areas were included in the call for nominations for Lease Sales 72 and 74, scheduled for May and August 1983, respectively. Howell Hook and Pulley Ridge Areas will not be offered in Lease Sales 72 and 74, but they will be offered in Lease Sale 79, scheduled for November 1982 in the eastern Gulf. Howell Hook and Pulley Ridge Areas are also on the West Florida Shelf off the coast of southwest Florida.

Looking well into the future, exploration activity could someday take place on the deep abyssal plain of the Maritime Boundary region of the Gulf of Mexico. The Maritime Boundary region encompasses a portion of the Gulf where jurisdiction over natural resources by adjacent coastal countries has not yet been established. Water depths in 75 percent of this region exceed 10,000 feet (3,048 m). A recent U.S. Geological Survey study (Powers, 1981) concluded that favorable geologic conditions exist within this region for the occurrence of crude oil and natural gas resources.

In the course of exploring for, developing, and producing offshore oil and gas, certain geologic features and conditions may jeopardize offshore platforms and pipelines. Failure to identify, avoid, or take proper engineering precautions against geologic hazards could result in the failure of a platform or pipeline.

Geohazards in the Gulf of Mexico OCS can be grouped into the following categories: (1) soil movements (unstable slope/sediment instability), (2) active faults, (3) shallow gas accumulations, (4) thick, soft sediment accumulations, and (5) karst topography. While some of these hazards are common to the entire Gulf, others are likely in specific locations.

Mass slumping, sediment creep, and submarine landslides are examples of geologic hazards found along the slopes and in the Upper Mississippi Fan. The least stable sediments are in the region just off the Mississippi River, where large volumes of river-borne sediments are deposited each year. These sediments, because of their rapid rate of deposition, generally have a high content of water and organic material. The fine-grained sediments of the delta region are often unstable as a result of trapped, organically derived gas and saturated conditions.

Active faulting in the Gulf of Mexico is associated with areas of rapid deposition, such as the Mississippi Delta, or on steep slopes where stress caused by sediment loading may be released by sudden movements. Faulting in sediments overlying salt domes is also common in the northern Gulf of Mexico.

Shallow accumulations of gas in the sediment can be generated by either bacterial decomposition or the movement of natural gas upward from a deeper reservoir. Pockets of gas in shallow, high-pressure zones within the sediment have been the cause of blowouts during offshore drilling operations (BLM, New Orleans OCS Office, 1979). In addition, highly unconsolidated, gas-saturated alluvial deposits can lead to differential compaction.

The Florida Carbonate Platform contains geologic hazards that may not be present elsewhere in the Gulf of Mexico Region. These consist of limestone formations with karst topography. Karst topography consists of openings and caverns dissolved out by groundwater. It occurs in porous Eocene limestone strata over 1,970 feet (600 m) thick and is located between 590 to 985 feet (180-300 m) below the shelf's surface. Concentrations of sinkholes, formed either by solution of surface limestone or by collapse of underlying solution caverns, are present. Unstable slopes are found at the shelf-slope break, being more common at the northern edge of the West Florida Shelf than to the south.

Existing standard design and engineering technology can be used to minimize the effects of these problems, especially such features and conditions as local thickening and thinning of clastic deposits and differential compaction of sediments. In areas where other operational constraints have been identified, special engineering procedures may be required, proposed well locations may have to be changed, or blocks may have to be developed from adjoining blocks. In locations where deepwater and unstable bottoms associated with mass movement of sediments are present, as in the area of the delta, conventional

drilling rigs and platforms may be inadequate. More elaborate structures, designed to withstand the greater stresses of exploring and producing under adverse conditions, are being constructed.

Before OCS blocks are explored and developed, the petroleum industry conducts surveys to identify potential geohazards. A hazard survey is submitted with each plan of exploration. Additional site-specific hazard surveys may be required when an application for permit to drill is submitted or when the Minerals Management Service (MMS) District Supervisor deems these additional hazard surveys necessary.

OIL AND GAS RESOURCE AND RESERVE ESTIMATES FOR THE GULF OF MEXICO

The most recent official appraisal of undiscovered recoverable oil and gas resources in the Gulf of Mexico was made in 1980 (Dolton and others, 1981a). The appraisal was part of an overall reappraisal of oil and gas resources, which encompassed the entire United States and included both onshore and offshore estimates. The 1980 appraisal updates the 1975 analysis (Miller and others, 1975) and incorporates new geologic information, new technology, economic changes, and more sophisticated methods of resource evaluation. The resource estimates in this report are those of the U.S. Geological Survey. However, future resource estimates will be those of the new Minerals Management Service.

Undiscovered, recoverable oil and gas resources are those that could be produced economically under existing technology and price/cost relationships, assuming normal short-term technological development. These resources consist of crude oil, condensate, and natural gas. Crude oil is a natural mixture of hydrocarbons occurring underground in a liquid state in reservoir rock and remaining in a liquid state as it is produced from wells. Condensate is a hydrocarbon liquid produced with natural gas but separated from the gas by cooling or various other means. Natural gas is a mixture of gaseous hydrocarbons occurring underground in reservoir rock; in association with crude oil as free gas; dissolved in crude oil; or in a free state not associated with crude oil. Undiscovered, recoverable resources are those resources yet undiscovered but estimated to exist in favorable geologic settings. Not included in the estimate are quantities that may yet be found in new pays or extensions of existing fields. The shaded portion shown in figure 2 indicates the economic and probability of occurrence relationships between undiscovered recoverable resources and reserves as used in this report.

Estimates of undiscovered, recoverable resources are made on a regionwide basis. The Gulf of Mexico (offshore) is one of 15 such petroleum regions into which the United States is divided. The Gulf of Mexico was further subdivided into two petroleum provinces: the eastern Gulf and the western Gulf. The 1980 appraisal includes estimates for the Continental Slope. This has resulted in an increase in the size of the areas assessed in the 1975 appraisal.

Resource estimates are based on a careful analysis and review of a petroleum province's geology, exploration history, volumetric yield procedures, finding-rate studies, and structural analyses. Because resource estimates involve uncertainty, estimates of quantities are usually expressed as a range of values corresponding to different probability levels. Only mean values are included in this report because they represent the estimate of the most probably quantity of resource associated with the greatest likelihood of occurrence. Table 1 shows the most recent Gulf of Mexico OCS oil and gas resource and reserves estimates.

Frontier areas, such as the eastern Gulf, pose special problems concerning accurate resource appraisal. Little or no drilling in those areas usually means there is a lack of information regarding geologic structures, drilling history, or the presence of hydrocarbon regimes. There is a chance that recoverable petroleum may not exist, and resource estimates may be the analysis of optimistic petroleum geologists, resulting in uncertain values commonly known as probability estimates. Results of exploratory drilling in the eastern Gulf have thus far been disappointing, and

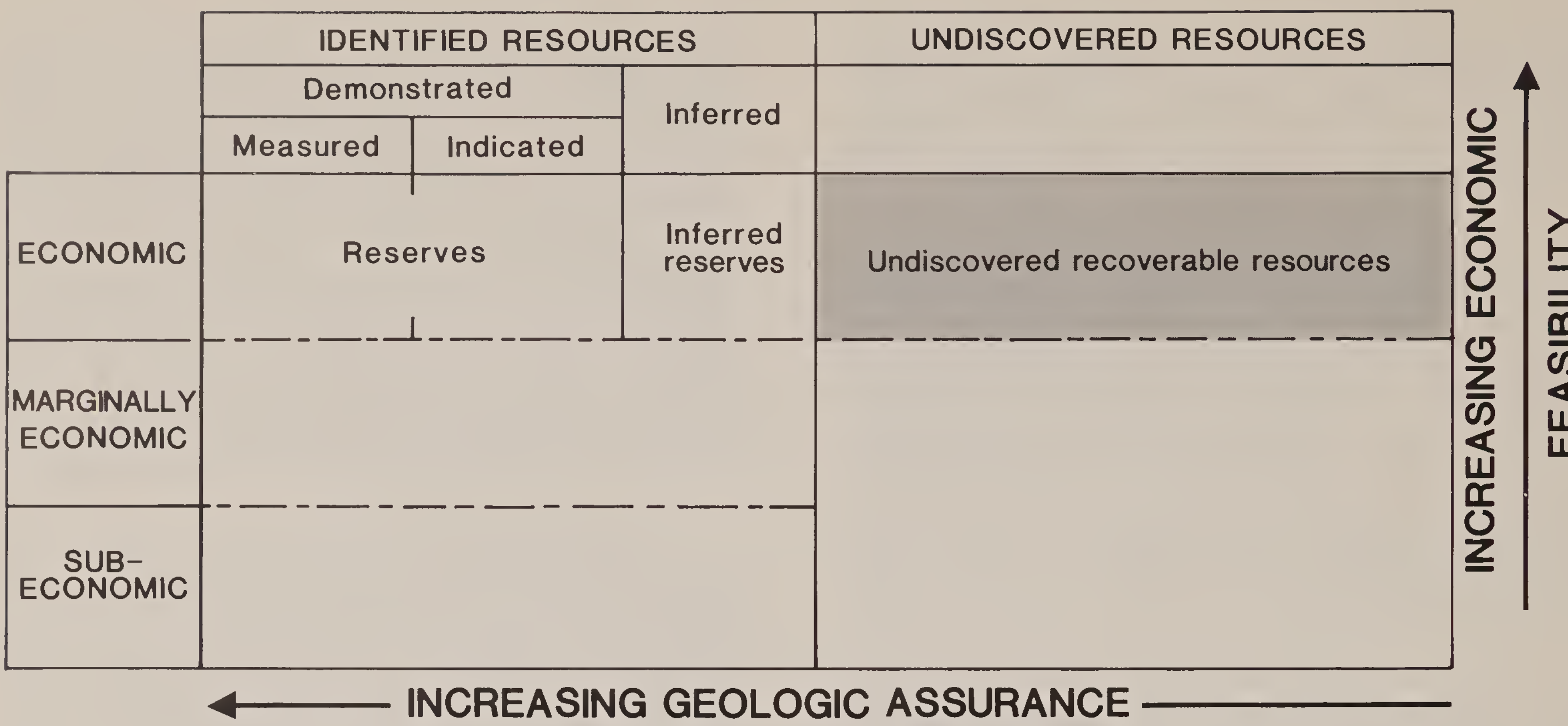


FIGURE 2.--Hydrocarbon resource classification (shaded area indicates the undiscovered recoverable resources estimated in the present study). (Redrafted from Dolton and others, 1981a, by Rogers, Golden & Halpern, 1982.)

geologic information obtained from those provinces indicates a reduced estimate of hydrocarbon potential from the earlier 1975 estimates.

The Minerals Management Service of the Department of the Interior estimates oil and gas reserves. Reserves constitute that portion of identified resources that can be economically extracted. Estimates of original recoverable reserves, cumulative production, and remaining recoverable reserves as of December 31, 1981, in the Gulf of Mexico were completed in April 1982 (Hewitt and others, 1982).

As of December 31, 1981, the Minerals Management Service Gulf of Mexico Regional Field Names Committee listed 489 active fields in the federally regulated portion of the Gulf of Mexico. Sufficient development on 445 of those fields has occurred, allowing an estimate of their reserves. The remaining 44 fields were not sufficiently developed to permit a reasonably accurate estimate of reserves. No estimates are available for those insufficiently developed fields.

Reserve estimates have been calculated for a total of 461 fields on the Gulf of Mexico OCS; however, 16 of those fields are depleted and have been abandoned after significant production. The Regional Field Names Committee does not include the 16 depleted fields among the 489 active fields on its current list. Table 2 shows estimated oil and gas reserves for 461 fields by areas in the Gulf of Mexico Outer Continental Shelf and Slope. In cases where fields lie partly in State waters and partly in Federal waters, estimated reserves are for the Federal portion only.

The Minerals Management Service monitors changes in field reserves through its Field and Reservoir Reserves Estimate (FRRE) data processing system. The system currently tracks changes in the 461 above-mentioned fields (445 active fields and 16 depleted fields), and it allows for a periodic update of reserve estimates.

TABLE 1.—Gulf of Mexico OCS oil and gas resource and reserve estimates

	Oil (billion barrels)	Gas (trillion cubic feet)
Undiscovered recoverable resource estimates (mean estimates)[1]		
Western Gulf of Mexico (Main Pass Area (see plates) and west)		
Shelf (0-200 m water depth)	2.8	42.9
Slope (>200 m water depth)	2.4	26.1
Eastern Gulf of Mexico (east of Main Pass Area)		
Shelf (0-200 m water depth)	1.2	2.4
Slope (>200 m water depth)	.2	.5
Reserves	2.9	39.8

[1]Undiscovered recoverable resource estimates to date have not been separately calculated for the central Gulf of Mexico

SOURCES: USGS, Geologic Division (resource estimates), 1981; MMS, Resource Estimates Section (reserve estimates), December 31, 1981.

Reserve estimates for the 461 fields are based on one or more specific evaluation techniques. The Minerals Management Service conducted studies of nearly 13,400 individual reservoirs to make estimates for 355 of the fields. Volumetric estimates were made for each reservoir and, for many of the reservoirs, additional estimation methods such as decline curve analyses were used. Reservoir performance is periodically compared to original predictions. Predictions may then be revised accordingly. Estimates for the remaining 106 fields in the FRRE system were made on a field-wide basis from production studies; for non-producing fields, volumetric estimates were used.

To report original recoverable reserves from the abandoned fields where production occurred, each field was assigned a value equal to the amount that the field actually produced.

Of the 461 FRRE system fields, 99 are primarily oil-producing and 362 are primarily gas-producing fields. Figures 3 and 4 show the field-size distribution for oil and gas fields, respectively. Median field size (50 percent of the fields are larger and 50 percent smaller) for the oil fields is 34 million barrels (5,402,600 m3) of oil, and the mean field size (weighted average) is 68 million barrels (10,805,200 m3) of oil. Oil fields with original

TABLE 2.—Estimated demonstrated oil and gas reserves for 461 fields by area, Gulf of Mexico Outer Continental Shelf and Slope, December 31, 1981

(Demonstrated reserves: the sum of measured and indicated reserves. Oil expressed in millions of barrels, gas in billions of cubic feet. "Oil" includes crude oil and condensate; "gas" includes associated and non-associated gas. Remaining reserves estimated as of December 31, 1981.)

Area(s)	Number of fields: Studied		Not studied	Active with production	Original recoverable reserves		Cumulative production through 1981		Remaining recoverable reserves	
	Active	Depleted			Oil	Gas	Oil	Gas	Oil	Gas
Mustang Island and Padre Island	9	0	4	0	0	440	0	0	0	440
Matagorda Island	8	0	2	5	0	310	0	30	0	280
Brazos	8	2	2	7	4	720	2	350	2	370
Galveston	8	0	0	6	25	830	20	660	5	170
High Island and Sabine Pass (TX)	61	0	3	47	180	7,600	30	2,600	150	5,000
West Cameron and Sabine Pass (LA)	59	2	5	58	200	15,500	80	8,100	120	7,400
East Cameron	35	3	0	33	180	6,800	90	4,600	90	2,200
Vermilion	47	3	6	43	360	11,300	200	7,300	160	4,000
South Marsh Island	35	1	5	33	570	10,000	300	5,800	270	4,200
Eugene Island	50	1	3	43	1,170	12,300	740	7,900	430	4,400
Ship Shoal	35	1	3	33	920	8,700	640	5,500	280	3,200
South Timbalier and Bay Marchand	18	1	1	18	1,050	4,600	860	2,900	190	1,700
South Pelto	5	0	1	4	100	410	60	200	40	210
Grand Isle	9	1	2	9	820	3,800	650	2,400	170	1,400
West Delta	16	0	0	15	1,130	4,100	800	2,600	330	1,500
South Pass	8	0	1	8	620	1,600	390	920	230	680
Main Pass and Breton Sound	22	1	3	18	620	2,600	390	1,700	230	900
Continental Slope*	12	0	3	4	220	1,800	15	20	205	1,780
Subtotal	445	16	44	384	8,169	93,410	5,267	53,580	2,902	39,830
Total	461									

*Continental Slope includes the following areas: Corpus Christi, East Breaks, Garden Banks, Green Canyon, Ewing Bank, Mississippi Canyon, and Viosca Knoll.

SOURCE: Hewitt and others, 1982.

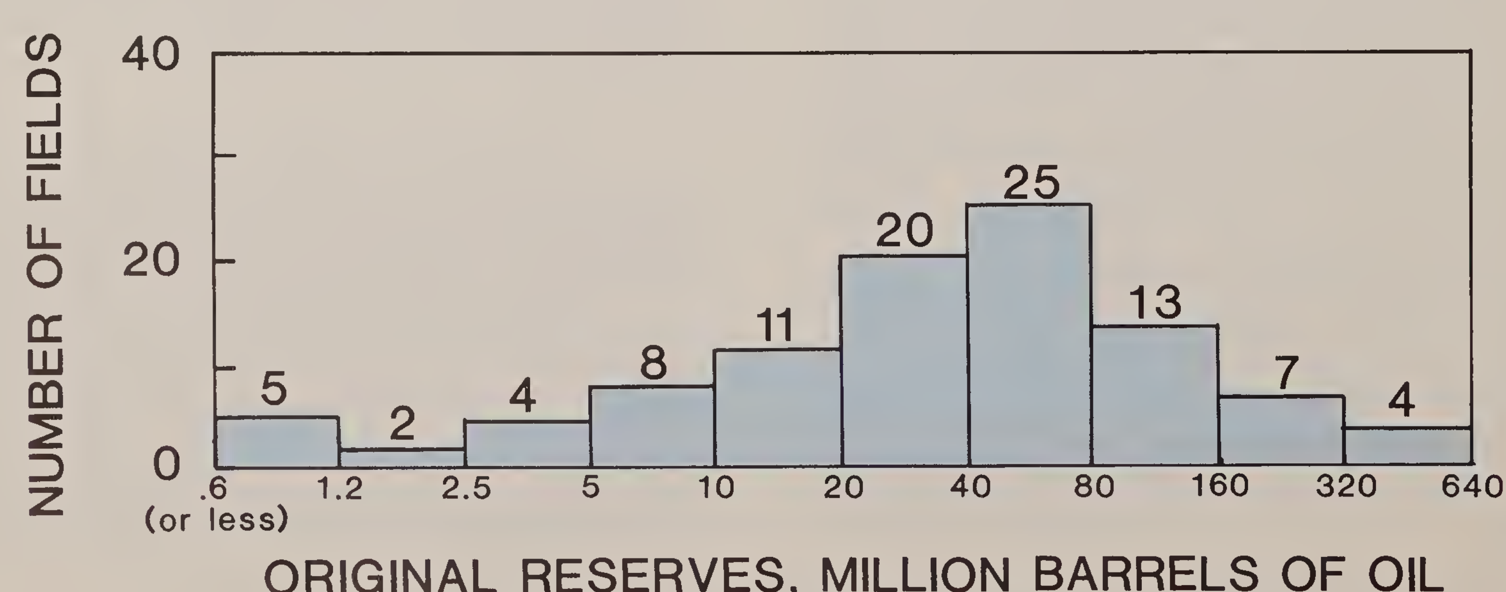


FIGURE 3.—Field-size distribution, 99 oil fields. (Adapted from Hewitt and others, 1982, by Rogers, Golden & Halpern, 1982.)

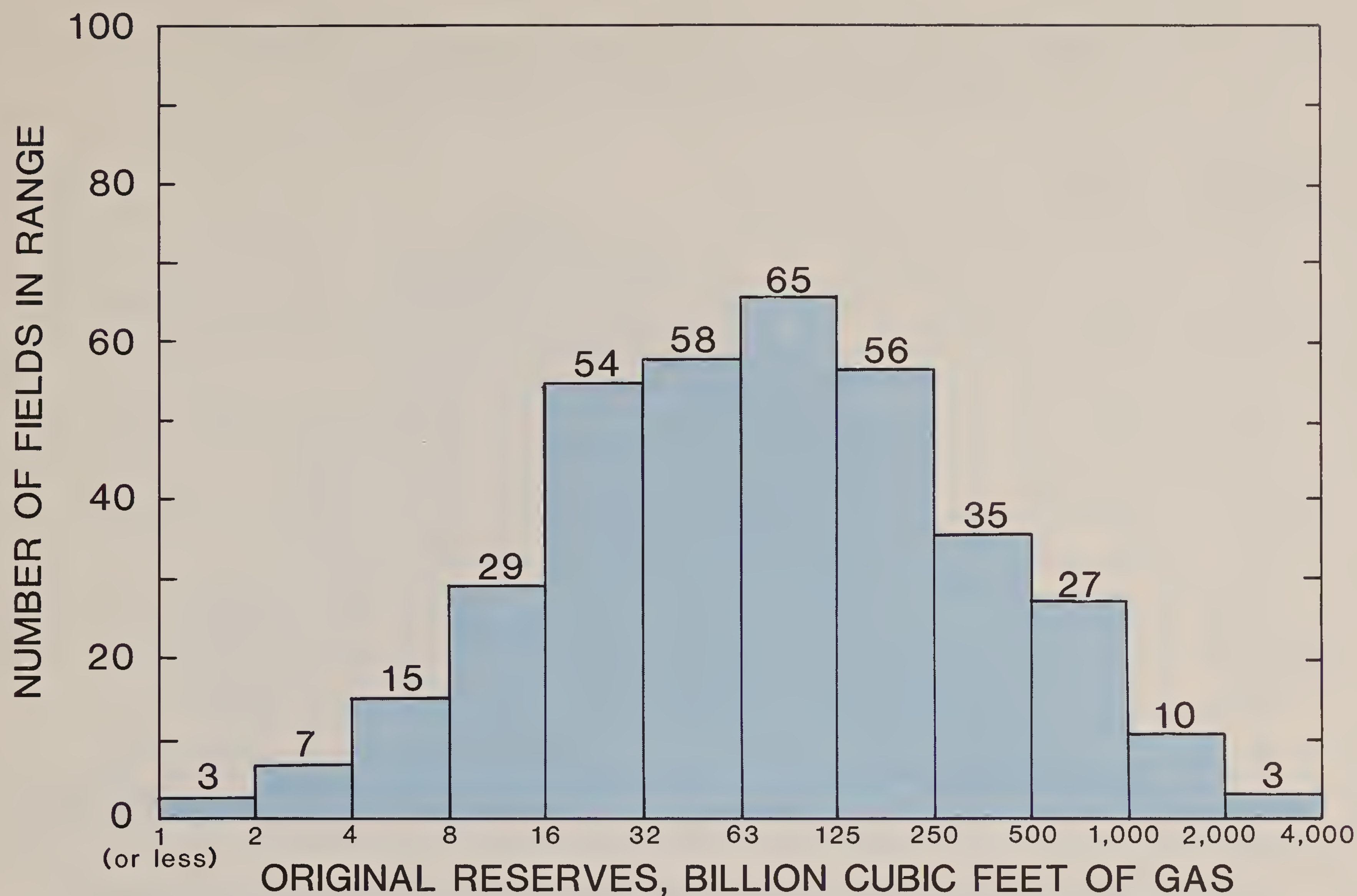


FIGURE 4.--Field-size distribution, 362 gas fields. (Adapted from Hewitt and others, 1982, by Rogers, Golden & Halpern, 1982.)

recoverable reserves of 100 million barrels (15,890,000 m3) are commonly known within the oil industry as "major fields." Seventeen of the 99 fields are considered major fields; together they account for 58 percent of the total original recoverable reserves in the 99 fields.

Median field size among the 362 gas fields is 76 billion cubic feet (2,150,800,000 m3), and the mean field size is 203 billion cubic feet (5,744,900,000 m3) of gas. Fifty-two percent of the total recoverable gas reserves were in the 36 largest fields.

To facilitate comparison, oil and gas fields may be combined into a single figure with hydrocarbon reserves expressed in barrels of oil equivalent (BOE). Figure 5 shows the total field-size distribution. A conversion factor of 5,400 standard cubic feet (153 m3) of gas equals 1 BOE may be used to express the average heating value of Gulf of Mexico OCS hydrocarbons. Using that conversion, median field reserve is 20 million BOE and the mean field size is 55 million BOE. Ten percent of the fields (the largest 46 fields in terms of BOE) account for 51 percent of the total recoverable hydrocarbon reserves in the Gulf of Mexico OCS (Hewitt and others, 1982).

The minimum economic field size that will allow successful (profitable) development varies among offshore regions. Recoverability is often uncertain because of severe technologic and economic constraints imposed by the operating conditions. Minerals Management Service professionals have arbitrarily identified minimum field sizes for undiscovered recoverable resources that may be developed in offshore areas. Those for the Gulf of Mexico offshore area appear in table 3. Minimum

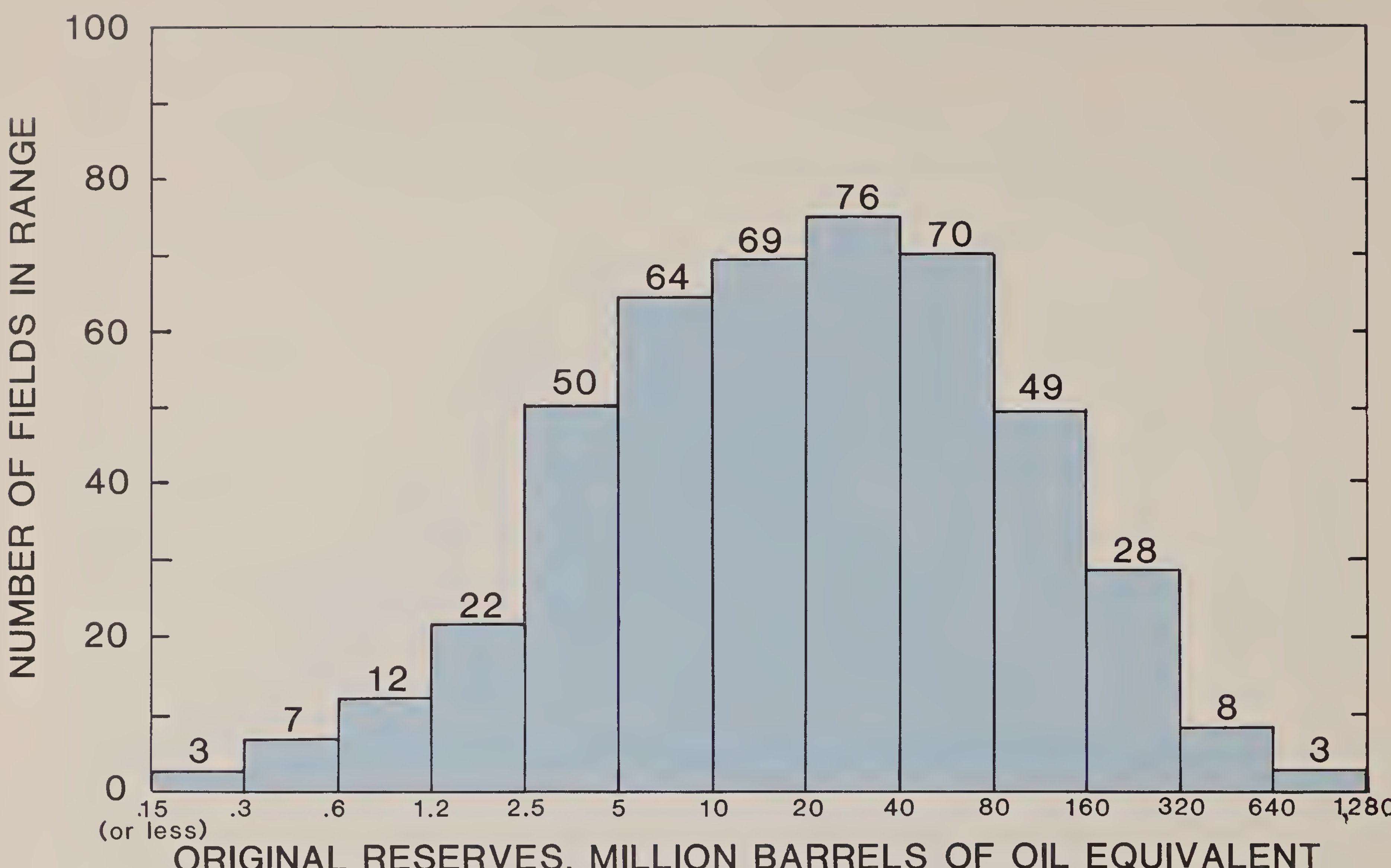


FIGURE 5.--Field-size distribution, 461 oil and gas fields. (Adapted from Hewitt and others, 1982, by Rogers, Golden & Halpern, 1982.)

TABLE 3.—Estimates of minimum economic field sizes for the Gulf of Mexico offshore area

(Note: To obtain metric equivalent (cubic meters), multiply barrels of oil by 0.1589 and cubic feet of gas by 0.0283.)

Water depth feet (m)	Oil (million barrels)	Gas Non-associated* (billion cubic feet)
10 to 98 (3-30)	0.6-1.0	2-5
98 to 328 (30-100)	1.0-2.0	5-15
328 to 656 (100-200)	2.0-5.0	15-30
656 (200)	5.0-50	30-200

*Non-associated gas is natural gas that is not associated with or not in contact with crude oil within a reservoir.

SOURCE: Dolton and others, 1981a, p.8.

economic field sizes for the Gulf of Mexico are the most favorable among all offshore areas in the United States.

The total of all identified oil and gas fields in the Gulf of Mexico OCS increased to 505, as of December 31, 1981, from 482 at the end of the previous year (Hewitt and others, 1981, and Hewitt and others, 1982). Those 23 fields are a net increase of 4.77 percent. The number of depleted fields (16) was the same as reported in the December 31, 1980, Open-File Report (81-604). The active fields as listed by the Minerals Management Service Gulf of Mexico Regional Field Names Committee increased from 466 to 489 over the same period. Fields for which reserve estimates have been made increased from 419 to 445 or 6.21 percent. Table 4 presents a summary of Gulf of Mexico OCS oil and gas field changes since December 31, 1980.

TABLE 4.—Summary of Gulf of Mexico OCS oil and gas fields as of December 31, 1980, and December 31, 1981

Fields	12/80	12/81	Net Change	Percent Change
Identified fields in the Gulf of Mexico OCS	482	505	+23	4.77
Depleted fields (abandoned after significant production)	16	16	0	0
Active fields listed by MMS Gulf of Mexico Regional Field Names Committee	466	489	+23	4.94
New or recently discovered fields insufficiently developed to allow reasonably accurate reserve estimates	47	44	-3	-8.51
Fields with reserve estimates	419	445	+26	6.21
Oil fields with reserve estimates (including depleted fields)	n.a.	99	n.a.	n.a.
Gas fields with reserve estimates (including depleted fields)	n.a.	362	n.a.	n.a.

n.a. = data not available.

SOURCE: Hewitt and others, 1981, p.6, and Hewitt and others, 1982, pp.3-4.

Estimates of undiscovered recoverable resources, although showing no change from those reported in the Gulf of Mexico Summary Report 2, differ significantly from the regional estimates for the Gulf of Mexico published in 1975 by Miller and others. These differences result from new data, and they provide the best available understanding and evaluation of the Gulf Region's petroleum potential. Exploratory drilling in the eastern Gulf of Mexico has so far produced disappointing results, and geologic information gathered from this area suggests a reduced estimate of hydrocarbon potential compared to earlier resource estimates.

A summary of estimated oil and gas reserves in the Gulf of Mexico OCS as of December 31, 1981, shows changes when compared to the previous year-end reserve estimates (December 31, 1980) as reported in the Gulf of Mexico Summary Report 2. Table 5 presents a summary of oil and gas reserves for the calendar years ending in 1980 and 1981. Over the 1-year period, new discoveries, revised estimates, and other adjustments increased the original recoverable oil and gas reserve estimates by 0.13 billion barrels (52,598,000 m3) and 4.5 trillion cubic feet (127,350,000,000 m3), respectively. Oil production for 1981 was 0.27 billion barrels

TABLE 5.—Summary of Gulf of Mexico OCS oil and gas reserves as of December 31, 1980, and December 31, 1981

		Oil (billion barrels)		Gas (trillion cubic feet)
Original Recoverable Reserves:				
Previous estimate, yr. ending 12/31/80		8.04		88.9
Discoveries, revisions, adjustments	+0.13		+4.5	
Net change		+0.13		+4.5
Current estimate, yr. ending 12/31/81		8.17		93.4
Cumulative Production:				
Prod. through yr. ending 12/31/80		4.99		48.7
Current prod. & other adj. yr. end. 12/31/81		+0.28		+4.9
Prod. through yr. ending 12/31/81		5.27		53.6
Remaining Recoverable Reserves:				
Previous estimate, yr. ending 12/31/80		3.05		40.2
Discoveries, revisions	+0.12		+4.5	
Production for 1981	-0.27		-4.9	
Net change		-0.15		-0.4
Current estimate, yr. end 12/31/81		2.90		39.8

SOURCE: Hewitt and others, 1982, p.14.

(109,242,000 m3) and gas production was 4.9 trillion cubic feet (138,670,000,000 m3). The excess in production of oil and gas when compared to additions to original recoverable reserves through discoveries and revised estimates shows a net decrease in remaining recoverable reserves.

OIL AND GAS RESOURCES IN THE GULF OF MEXICO LEASE SALE AREAS

Oil and gas resource estimates currently exist for each of the five lease sales being considered in this edition of the summary report. These include Lease Sale 67, held in February 1982, and upcoming Lease Sales 69, 72, 74, and 79.

Together, acreage studied for Lease Sales 67 and 69 consisted of nearly 2,458,827 acres (995,087 hectares) covering 472 tracts distributed throughout the western, central, and eastern Gulf. Tracts for Lease Sale 67 numbered 234, comprising 1,170,456 acres (473,684 hectares). Tracts leased in Sale 67 numbered 115, consisting of 590,249 acres (238,874 hectares) for $1,193,654,719.67. There were 290 bids received on 137 tracts; high bids totaled $2,683,699,842.97; and the highest bid was $55,119,000 for Tract 107 awarded to Mobil. Tracts proposed for Lease

Sale 69 number 271 and comprise 1,405,222 acres (568,693 hectares). Tracts for both sales lie from 3 to 140 nautical miles (5.5-259 km) offshore in water depths ranging from 6.0 to 4,100 feet (1.8-1,250 m).

The U.S. Geological Survey has issued oil and gas resource estimates for the acreage included in Lease Sales 67 and 69. Mean resources estimates for the Lease Sale 67 tracts are 75.16 million barrels (11,942,924 m3) of oil and 1.03 trillion cubic feet (29,149,000,000 m3) of gas. Mean resource estimates for Lease Sale 69 are 48.24 million barrels (7,665,336 m3) of oil and 785.54 billion cubic feet (22,230,782,000 m3) of gas.

The draft regional environmental impact statement for proposed OCS oil and gas Lease Sales 72, 74, and 79 in the Gulf of Mexico contains resource estimates for the respective planning areas to be offered in each sale. Resource estimates, discussed in this section for these sales, are for a most likely find scenario. Lease Sale 72 in the central planning area will include all unleased blocks consisting of approximately 39 million acres (15,783,300 hectares) and is estimated to have 97 million barrels (15,413,300 m3) of oil and 1.048 trillion cubic feet (29,658,400,000 m3) of gas. Lease Sale 74 in the western planning area will include approximately 33 million acres (13,355,100 hectares) of unleased acreage with estimates of 29 million barrels (4,608,100 m3) of oil and 525 billion cubic feet (14,857,500,000 m3) of gas. Lease Sale 79 in the eastern planning area will consist of nearly 58 million acres (23,472,600 hectares) and is estimated to have 123 million barrels (19,544,700 m3) of oil and 157 billion cubic feet (4,443,100,000 m3) of gas.

2. Magnitude and Timing of OCS Development

This chapter of the Gulf of Mexico Summary Report will focus on the magnitude and timing of Outer Continental Shelf (OCS) exploration, development, and production, and the factors that can affect these activities. The chapter reviews the Gulf of Mexico's leasing history, along with a summary of current activities and a projection of future developments.

As the pace and magnitude of future OCS activity will depend heavily on the Federal Government's leasing program and policies, a section has been included describing the proposed 5-year leasing schedule and associated efforts to streamline leasing procedures. An additional factor that can influence the magnitude and timing of OCS development, namely boundary disputes, is reviewed in appendix B.

OCS LEASE SALES

Historic Update

The first general Gulf of Mexico oil and gas lease sale was held on October 13, 1954. From that time through 1970, only 10 more general lease sales were held; other sales were drainage sales. The pace of leasing increased to two sales per year in 1972 and 1973. In resonse to the Arab oil embargo of 1973-74, lease sales further increased to seven in the 2-year period from January 1974 through December 1975. The rate returned to approximately two lease sales per year in 1976. The Department of the Interior's final 5-year oil and gas leasing schedule, approved in July 1982, projects from two to three sales per year for a total of 12 through June 1987 (DOI, 1982b). Table 6 presents a summary of past lease sales and proposed sales for the Gulf of Mexico.

LEASE SALE 66. Lease Sale 66, held in New Orleans, Louisiana, on October 20, 1981, offered 209 tracts in the central and eastern Gulf of Mexico covering more than 1 millon acres (404,700 hectares). Bids were received on 107 tracts. The total bonus for leased tracts was $1.24 billion. Ninety-one tracts were offered in the eastern Gulf, off Florida. Only 20 of these tracts were bid upon, and leases were subsequently awarded to Shell Oil Company for all 20. These leases are all in the Charlotte Harbor administrative area. The balance of tracts receiving bids were in the South Pass, Main Pass, and Main Pass South and East Addition Areas. These areas off Louisiana have received a great deal of industry interest in previous lease sales.

The highest bid was for Tract 110, in the Mississippi Canyon Area. The lease was awarded to Sohio, in return for a cash bonus of $133.75 million.

Acreage offered in Lease Sale 66 was 3 to 112 nautical miles (5.6-207 km) offshore, in water depths ranging from about 6 feet (1.8 m) to about 1,640 feet (500 m). Tenneco was the winner of the tract in deepest water. Tract 120 lies in the Green Canyon Area off Louisiana, in 1,640 feet (500 m) of water. The following data illustrates the tracts by water depth:

- 45 tracts - less than 150 feet (45 m);
- 39 tracts - 151 to 300 feet (46-91 m);
- 17 tracts - 301 to 1,000 feet (92-305 m); and
- 6 tracts - over 1,000 feet (305 m).

TABLE 6.—Summary of Gulf of Mexico OCS oil and gas lease sales and proposed sales through June 1987, based on final schedule

Year	Sale[1]	Sale date	Sale[2] type	Planning areas[3]	Tracts offered		Tracts bid on		Tracts leased	
					Number	Acres[4]	Number	Acres[4]	Number	Acres[4]
1954	1	10/13	G	C	199	748,819	90	394,721	90	394,721
	2	11/9	G	W	38	111,788	19	67,148	19	67,148
1955	3	7/12	G	C&W	210	674,095	121	402,566	121	402,566
1956		No sales								
1957		No sales								
1958		No sales								
1959	5	5/26	G	E	80	458,000	23	132,480	23	132,480
	6	8/11	D	C	38	81,812	28	62,967	19	38,819
1960	7	2/24	G	C&W	385	1,610,254	173	813,663	147	704,526
1961		No sales								
1962	9	3/13	G	C	401	1,808,275	212	918,407	206	956,407
	10	3/16	G	C&W	410	1,875,984	210	977,092	205	956,592
	11	10/9	D	C	19	38,854	14	24,857	9	16,177
1963		No sales								
1964	12	4/28	D	C	28	34,027	23	32,671	23	32,671
1965		No sales								
1966	14	3/29	D	C	18	35,993	18	35,993	17	35,055
	15	10/18	D	C	52	227,898	32	134,717	24	104,717
1967	16	6/13	G	C	206	971,488	172	812,202	158	744,456
1968	18	5/21	G	W	169	728,550	141	666,630	110	541,304
	19	11/19	D	C	26	46,824	21	40,261	16	29,679
1969	19A	1/14	D	C	38	96,388	26	61,628	20	48,504
	19B	12/16	D	C	27	93,763	16	60,153	16	60,153
1970	21	7/21	D	C	34	73,359	21	50,889	19	44,642
	22	12/15	G	C	127	593,485	127	593,485	119	553,897
1971	23	11/4	D	C	18	55,872	13	42,222	11	37,222
1972	24	9/12	G	C	78	366,681	74	346,692	62	290,320
	25	12/19	G	C	132	604,029	119	548,374	116	535,874
1973	26	6/19	G	C&W	129	697,643	104	566,573	100	547,173
	32	12/20	G	E	147	817,297	89	496,916	87	485,396
1974	33	3/28	G	C	206	930,918	114	522,396	91	421,218
	34	5/29	G	W	245	1,355,678	123	680,335	102	565,112
	S1	7/30	G	C&W	258	1,298,738	49	249,703	19	100,240
	36	10/16	G	C	297	1,421,545	157	733,926	144	675,586
1975	37	2/4	G	W	515	2,870,344	143	796,366	113	626,585
	38	5/28	G	C&W	283	1,346,431	102	486,327	86	406,941
	38A	7/29	G	C&W	345	1,772,958	80	408,008	66	336,300
1976	41	2/18	G	C,W&E	132	687,603	41	191,717	34	161,285
	44	11/16	D	C&W	61	254,488	48	201,825	43	178,127
1977	47	6/23	G	C&W	223	1,074,535	152	739,326	124	605,426
1978	45	4/25	GM	C&W	145	709,726	101	490,751	90	438,756
	65	10/31	G	E	89	511,709	35	201,294	35	201,294
	51	12/19	G	C&W	128	643,986	88	449,690	81	412,416

Year	Sale[1]	Sale date	Sale[2] type	Planning areas[3]	Tracts offered		Tracts bid on		Tracts leased	
					Number	Acres[4]	Number	Acres[4]	Number	Acres[4]
1979	58	7/31	G	C&W	123	577,516	88	424,029	81	391,182
	58A	11/27	G	C&W	124	588,600	96	450,913	90	421,519
1980	A62	9/30	G	C	192	909,207	147	706,042	116	551,643
	62	11/17	G	W	81	456,720	74	420,058	67	383,323
1981	A66	7/21	G	C&W	212	1,077,914	162	829,899	156	799,899
	66	10/20	G	C&E	209	1,081,364	107	532,064	102	508,301
1982	67	2/9	G	C,W&E	234	1,219,847	137	695,765	115	590,265
	69	October	G	C,W&E	269	1,397,880	--	--	--	--
1983	72	May	G	C						
	74	August	G	W						
	79	November	G	E						
1984	81	April	G	C						
	84	July	G	W						
1985	98	May	G	C						
	102	August	G	W						
	94	November	G	E						
1986	104	April	G	C						
	105	July	G	W						
1987	110	April	G	C						

[1]Prior to OCS Sale 33, designators (numbered designations) were not preassigned to OCS lease sales. For ease of reference, however, a designator has been assigned to each sale. OCS Lease Sale 4, a planned Gulf of Mexico sale, was cancelled in 1956.

[2]"G" indicates general oil and gas lease sale; "D" indicates drainage oil and gas lease sale; "GM" indicates government motion oil and gas lease sale.

[3]"C"=Central; "E"=Eastern; "W"=Western.

[4]OCS lease sales are traditionally made in terms of acres. To obtain the metric equivalent (hectares), divide the acreages by 2.47.

SOURCE: Minerals Management Service, Gulf of Mexico OCS Office, 1982, and DOI, 1982b.

Although all the deepwater tracts in this sale carried 5-year leases, the Department of the Interior (DOI) initiated a plan to offer 10-year leases in several tracts in Lease Sale 67, which is discussed next.

The U.S. Geological Survey (USGS) estimated about 50 million barrels (7,945,000 m3) of oil and 570 billion cubic feet (16,131,000,000 m3) of natural gas underlying the tracts offered in Lease Sale 66.

LEASE SALE 67. Lease Sale 67, held on February 9, 1982, offered 234 tracts, ranging over the entire Gulf of Mexico. High bids were received by the Bureau of Land Management (BLM) for 137 tracts, but 22 of the bids were rejected. Only 115 tracts were subsequently leased. All bidding in Lease Sale 67 was on the basis of cash bonus.

The lease sale tracts lie in waters from 3 to 121 nautical miles (5.6-224 km) from shore, with depths ranging from 6 to 4,100 feet (1.8-1,250 m) (BLM, New Orleans OCS office, 1982).

The highest cash bonus, more than $55 million, was offered for a shallow-water tract, Tract 107, located in 46-foot (14-m) waters south of Mobile Bay. Other tracts in this general area received considerable industry

interest; the majority of Mobile tracts offered in the lease sale received bids.

Deepwater acreage attracted industry interest, with bidding on 24 of the 44 deepwater tracts offered. The 44 tracts were offered with 10-year lease terms. This was the first Gulf of Mexico sale to offer leases with terms in excess of 5 years. Longer leases are designed to make exploration of deepwater tracts more economically feasible. Conoco, along with partners Getty Oil and Oxy Petroleum Company, purchased the largest number of deepwater tracts. Conoco was awarded 11 leases; those leases carried 10-year primary terms. The deepwater tract receiving the highest bid was Tract 132, located in 902 feet (275 m) of water in the Viosca Knoll Area; that bid was for $33.9 million. Some industry observers did not expect the deepwater acreage to draw much attention, because the current slow rise in crude prices could hamper the expansion of deepwater drilling and production (Ocean Construction Report, 1982b).

The U.S. Geological Survey's conditional mean estimate of recoverable resources for Lease Sale 67 tracts is 75.16 million barrels (11,942,924 m3) of oil and 1.03 trillion cubic feet (29,149,000,000 m3) of natural gas.

Future Lease Sales

Together, future general oil and gas lease sales will most likely encompass the entire Gulf of Mexico offshore area.

LEASE SALE 69. Lease Sale 69, which will offer tracts in the western, central, and eastern Gulf of Mexico, is scheduled for October 1982. Environmental impacts anticipated as a result of the lease sale were discussed in a final environmental impact statement (EIS) issued in September 1981. This EIS also discussed environmental issues surrounding Lease Sale 67. Tracts tentatively selected for Lease Sale 69 lie from 3 to 140 nautical miles (5.6-259 km) offshore, in water depths ranging from 6-1/2 feet to almost 7,900 feet (2.0-2,408 m). The tracts are scattered generally from off Padre Island on the lower Texas coast, and they extend through the West Cameron Area off Louisiana to the Chandeleur-Chandeleur East Area off Louisiana and Mississippi to the Mobile Area off Mobile Bay. Eastern Gulf tracts on the Florida Shelf are located from west of Sarasota to west of Naples.

Deepwater tracts to be offered in Lease Sale 69 represent about 9 percent of the sale's offerings. The Minerals Management Service has concluded that the oil and gas industry has the technology to safely explore for oil and gas in water depths to 8,200 feet (2,500 m), and that technology exists to safely produce in depths to almost 3,000 feet (914 m) (Oil & Gas Journal, 1981a).

The Minerals Management Service has estimated volumes of recoverable resources (mean values, not counting estimates from tracts rejected previously) that may be discovered as a result of Lease Sale 69 at 26.63 million barrels (4,231,507 m3) of oil and 614.06 billion cubic feet (17,377,898,000 m3) of natural gas.

LEASE SALES 72, 74, AND 79. About 130 million acres (5,261,100 hectares or about 25,000 blocks) on the Gulf of Mexico Outer Continental Shelf have been selected for environmental study preparatory to three separate 1983 oil and gas lease sales. Some 39 million acres (15,783,300 hectares) are in the Lease Sale 72 central Gulf area. The Lease Sale 74 area, in the western Gulf, contains about 33 million acres (13,355,100 hectares). The eastern Gulf area, to be offered in Lease Sale 79, contains roughly 58 million acres (23,472,600 hectares). Lease Sale 72 is scheduled for May 1983; Lease Sale 74, August 1983; and Lease Sale 79, November 1983.

The Minerals Management Service conducted a study of the selected areas and published a draft environmental impact statement (DEIS) in August 1982 covering all three proposed lease sales. The DEIS is available for public review at the Minerals Management Service office in Metairie, Louisiana. There will be only one set of public hearings for all three of the sales. After public hearings and

consultation with the affected coastal States, a final environmental impact statement will be published. Following publication of the final EIS, scheduled for January 1983, final decisions will be made regarding the size, location, and timing of the proposed lease sales.

In addition to the lease sales described above, seven others are listed on the final 5-year leasing schedule for the Gulf of Mexico. They are Lease Sales 81 and 84, scheduled for 1984; Lease Sales 94, 98, and 102, scheduled for 1985; Lease Sales 104 and 105, scheduled for 1986; and Lease Sale 110, scheduled for 1987. The initial administrative steps for these sales have not begun; therefore, information concerning these upcoming sales will appear in future editions of this summary report.

OCS EXPLORATION, DEVELOPMENT, AND PRODUCTION

The Gulf of Mexico has always been one of the most active areas for offshore drilling and production. At the present time, it is the most active area in the world. As of January 1982, 19,736 offshore oil and/or gas wells had been drilled in the Federal OCS. Most of them (17,257) are off the coast of Louisiana. Wells off of Texas number 2,213 and those off of Mississippi, Alabama, and Florida (MAFLA) number 266 (USGS, 1982a). Currently, there are 2,027 active oil and gas leases (including both Section 6 and Section 8 leases) in the Gulf of Mexico; 1,200 of these are producing leases (USGS, 1982a).

Exploration

The initial phase of offshore oil and gas operations is exploration. OCS exploration drilling may occur after a lease sale has been held and continues until either a discovery of economically recoverable resources is made or until a sufficient number of unsuccessful wells have been drilled to discourage further exploration. Exploratory activity may continue for several years after a lease sale.

Once a tract is leased, and prior to exploratory drilling on it, an operator must submit a plan of exploration (POE) to the Deputy Minerals Manager of the Minerals Management Service. The Minerals Management Service receives hundreds of plans of exploration annually. Plans of exploration include either initial, supplemental, or revised plans. Generally, only initial or supplemental plans indicate new exploratory activity. Between July 1, 1981, and June 30, 1982, the Minerals Management Service received 201 initial POE's and 132 supplemental POE's. **Plate 2** shows the distribution of exploratory activity by block, based on the POE's received by the Minerals Management Service.

There are various types of exploratory drilling rigs, including barges, jack-ups, drillships, submersibles, and semi-submersible rigs. The operator will choose the type of drilling rig for his exploratory venture according to rig availability, water depth, and bottom conditions on his tract. The onshore facilities needed to support offshore exploratory activity include permanent and temporary service bases and repair and maintenance yards. Apart from these service and supply bases, little onshore development accompanies exploratory operations, unless the drilling rigs themselves are fabricated in communities adjacent to the offshore area undergoing exploration. As of January 1982, there were 132 mobile drilling units working in the Gulf of Mexico OCS: 20 submersibles, 95 jack-ups, 15 semi-submersibles, and 2 drillships; 1 submersible and 3 jack-ups were under repair (USGS, 1982a).

Exploration in the Gulf of Mexico OCS, while quite dispersed compared to other offshore regions, does show some trends in terms of intensity of activity within the region. In 1981, there were 1,052 new holes started: 241 off Texas, 769 off Louisiana, and 42 off the MAFLA area. Although areas offshore from Texas have, in recent years, experienced large

increases in drilling activity, the majority of drilling has been and is taking place in the area off Louisiana. The filling-in of areas off Louisiana is occurring more frequently because of the renewed interest in tracts, previously leased and perhaps previously explored, that may have resources now seen to be economically recoverable due to the increase in crude prices. Two areas in particular have recently been the focus of exploratory drilling. They are the area off the Mississippi River Delta, and in the Garden Banks Area off western Louisiana. Most of the tracts in these areas have proven to be oil or oil-and-gas prone. Other promising areas off Texas have potential for producible quantities of natural gas.

In recent Gulf of Mexico OCS lease sales, interest has been clearly displayed in areas off Florida, most notably in the Charlotte Harbor and The Elbow administrative areas. Thirty tracts were leased by the Shell Oil Company in Lease Sales 66 (20 tracts) and 67 (10 tracts); these leases are in the Charlotte Harbor Area.

The geology of the Charlotte Harbor Area differs from that of the rest of the Gulf of Mexico Region. Operators hope that the Sunniland onshore trend extends offshore; the same types of Cretaceous carbonates underlie both onshore and adjacent offshore areas.

Although no exploration plans have yet been submitted for acreage acquired off Florida in Lease Sales 66 and 67, exploratory activities have been carried out on leases acquired in earlier MAFLA lease sales. These exploratory wells, drilled in the Destin Dome, Elbow, Vernon, Pensacola, and Charlotte Harbor administrative areas, have not resulted in discoveries of economically producible oil or gas. Exploration is currently under way on Sohio's Destin Dome Block 563. Figure 6 shows wells drilled, plugged, and abandoned in relation to Lease Sale 66 and 67 acreage.

UNITIZATION. Frequently, one or more hydrocarbon reservoirs underlies leases held by two or more companies. In such cases, a strong motivation exists for each company to explore for and produce as much oil and gas as possible from its own lease in order to prevent drainage of oil and gas to adjacent leases. In the past, this practice has led to needless and costly drilling and large-scale waste of oil and gas. Unitization is a method of discouraging such wasteful practices.

The Minerals Management Service's Minerals Manager in Metairie, Louisiana, has the authority to impose unitization if it is determined that "the national interest will be best served by unitization of a competitive reservoir" (30 CFR 250). The advantages of exploring and/or developing an area as a unit as that unnecessary wells and duplicative facilities may be avoided and the ultimate recovery of hydrocarbons may be maximized (see the accompanying sidebar on unitization).

Discoveries and Development

DISCOVERIES. Exploratory drilling may lead to discoveries of oil and gas. During 1981, a net increase of 23 new oil and/or gas fields were discovered in the Gulf of Mexico. This

Unitization is the practice of pooling all interest, ownership, and control in a producing field or part of a field. A "unit agreement" provides for a single operator or company to develop and operate several leases as if they were one. The purpose of the agreement is to maximize oil and gas recovery from reservoirs with multiple owners, while eliminating the drilling of unnecessary wells, reducing development and production costs, and ensuring the orderly development of petroleum resources.

As part of its supervisory role in the OCS production process, the Minerals Management Service encourages voluntary unitization. When operators fail to enter into unit agreements voluntarily, the Minerals Management Service initiates the formation of units where it is deemed necessary for conservation and protection of public resources. The Minerals Management Service administers operations in approved unitized areas.

Unitization is usually required for the effective use of most secondary and tertiary recovery operations where the petroleum reservoir underlies more than one lease. Of the 247 secondary recovery projects in effect in the Gulf as of the end of January 1982, 101 of them are within unitized areas (USGS, 1982b).

There are, as of January 31, 1982, 138 units in effect in the Gulf of Mexico OCS: 101 are reservoir units, and 37 are fieldwide or exploratory units (Guillory, 1982, oral commun.).

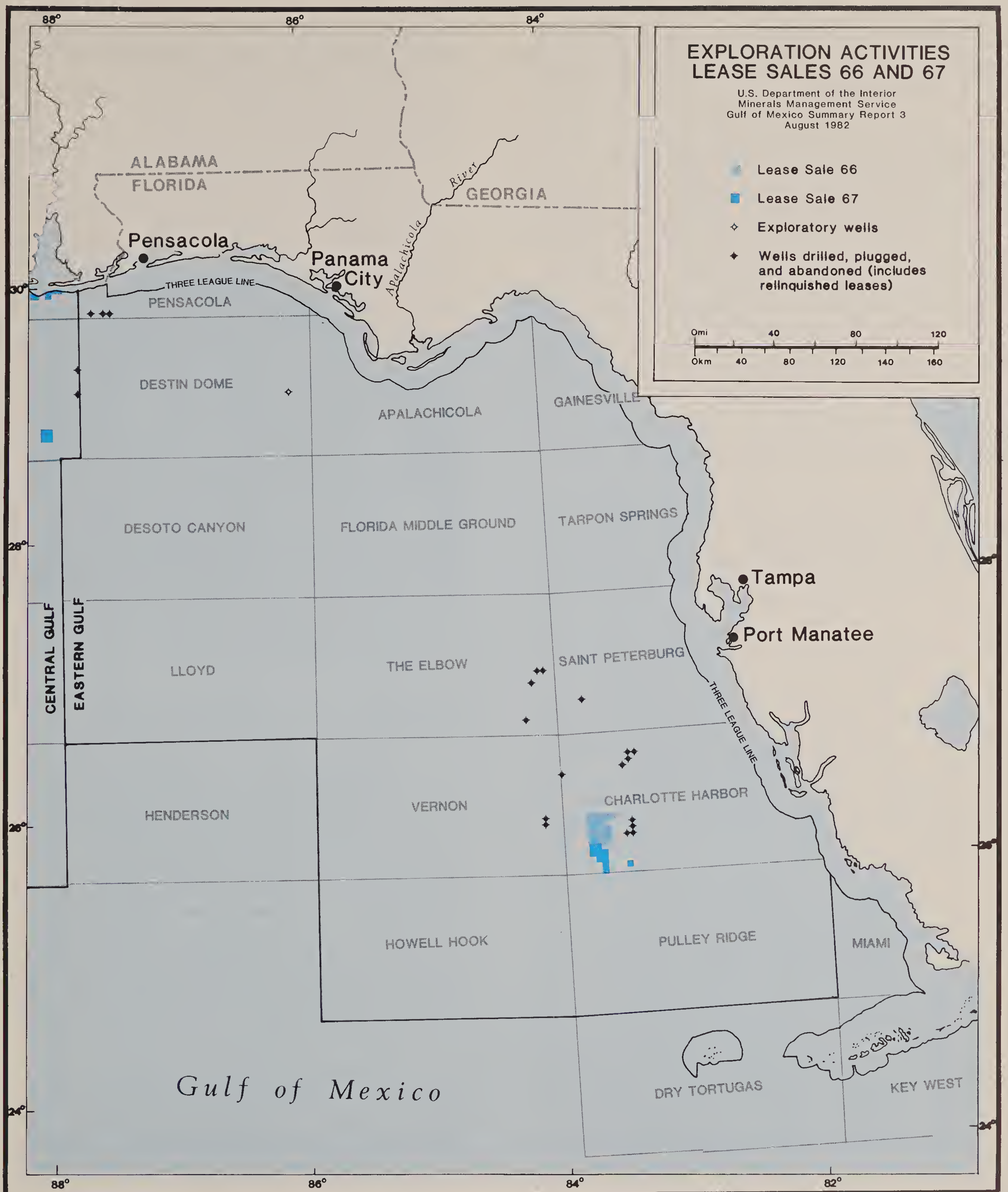


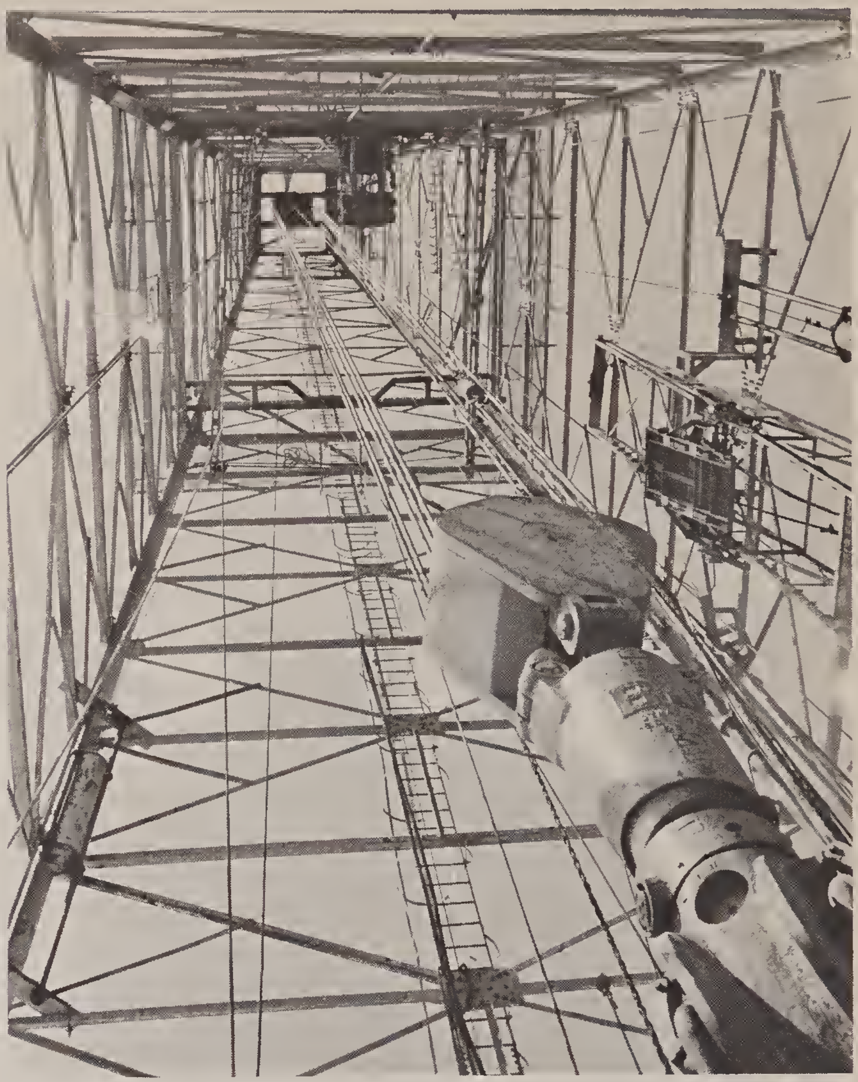
FIGURE 6.--Lease Sales 66 and 67 exploratory activity. (Redrafted from BLM, New Orleans OCS office, 1981c, by Rogers, Golden & Halpern, 1982).

compares to net increases of 25 fields in 1978, 51 fields in 1979, and 50 fields in 1980. Thus, the level of discoveries appears to be declining to the earlier level.

Hunt Oil Company of Dallas has found significant quantities of natural gas on its Eugene Island Block 77 field. The confirmation wells had a combined flow of more than 45 million cubic feet (1,273,500 m3) of gas per day as of February 1, 1982. Hunt owns 100 percent interest in each of the four Federal leases encompassing the field. Leases were purchased in OCS Lease Sale A66, held in July 1981. A contract has been let to Petro-Marine Engineering, New Orleans, to design a 100 million cubic feet (2,830,000 m3) of gas per day production platform to be installed on the Block 77 field in 1983 (Oil & Gas Journal, 1982a).

Marathon Oil Company discovered additional commercial quantities of gas on its South Pass Block 89 lease in 1980. A production platform has been installed, and gas production from the two-slot platform is expected to begin by June 1982, from four wells drilled prior to platform installation. Another platform, Platform A on another part of the lease, is projected to begin gas production during the third quarter of 1982. Marathon is the operator of the lease, with a 25 percent interest. Marathon's partners are Amerada Hess Corporation, Louisiana Land & Exploration Company, and OKC Corporation, each having a 25 percent interest also (Oil & Gas Journal, 1982d).

DEVELOPMENT ACTIVITY. OCS development can begin when an oil company makes a discovery of economically producible resources. From the time of the discovery, the company makes crucial decisions about the location and the construction of offshore and onshore facilities, as well as obtaining all the necessary permits from the various regulating agencies. Development activities, which are required to bring a field into production, include extensive planning, submission, and approval of plans of development and production (POD/P's), installation of platforms and pipelines, and development drilling. The onshore facilities required to support these activities may include permanent service bases, repair and maintenance yards, storage and treatment plants, and marine terminals.



Drill string. (Photograph by Jeffrey Wiese, Rogers, Golden & Halpern.)

Companies are usually required to submit a separate environmental report to a company's plans of exploration (POE's) and POD/P's. The environmental report, although a separate document, accompanies the plan throughout the review process. The purpose of the report is to assess the direct effects on the onshore and offshore environment that may result from implementing the POE or POD/P. As such, the environmental report may be used by States in planning for onshore impacts.

The environmental report, while not mandatory in the Gulf of Mexico Region, is required under special circumstances. Environmental reports are required for proposed activities off the Florida coast. They are also required under the following circumstances:

- in areas of potentially extreme seismic risk;

- in areas where marine sanctuaries have been designated or proposed, or in areas of high ecological sensitivity;
- in areas of potentially hazardous natural bottom conditions; and
- when new or unusual technology is being proposed.

States with approved Coastal Zone Management Programs may request an environmental report under the consistency provisions of the Coastal Zone Management Act.

Prior to the approval of a POE or POD/P, the Minerals Manager in the Minerals Management Service Regional Office reviews the environmental impacts of activities in the proposed plan. If the potential for a significant impact or some controversy exists, an environmental assessment is prepared for the plan. If the environmental assessment indicates that approval of the plan would constitute a major Federal action significantly affecting the quality of the environment, an environmental impact statement may be required.

The development phase in the OCS process is the time of most intense activity. It is during this period that the greatest impact will be felt by coastal communities in which support businesses will be located. In the western and central Gulf of Mexico Region, however, the impacts are lessened by the fact that the infrastructure necessary for development is already established; therefore, the requirements for each additional field add a relatively small increase to the region's workload. At the end of February 1982, there were 2,756 platforms in the Gulf of Mexico, a net increase of 197 over January 31, 1981.

In the Gulf of Mexico OCS, development activity is carried on continuously. Plans of development and production, including initial and supplemental plans, are submitted by the offshore operators to the Minerals Management Service's Gulf of Mexico OCS Office in Metairie, Louisiana. Submittals of these plans may exceed 100 per year. The large number of POD/P's submitted to the Minerals Management Service indicates a significant level of development ongoing constantly. Plans of development and production must include the following:

- a detailed description of drilling vessels, platforms, and structures, indicating where they are to be located, as well as their major features;
- the location of each well to be drilled;
- structural interpretations of the drilling area; and
- any other information the Minerals Management Service's Deputy Minerals Manager may require.

Public information copies of the plans can be reviewed at the Metairie, Louisiana, office of the Minerals Management Service.

PRODUCTION

In the production phase, oil or gas or both begin to be extracted from offshore wells. Hydrocarbons are then transported to shore in the pipelines laid during the development phase. If a new field cannot be economically linked to the existing pipeline network, the produced oil and gas may be transported to shore via tanker or barge.

Production has the longest duration of all phases of offshore operations; it may last for 20 years or longer. Characteristically, employment offshore drops sharply from the level of the development stage as production becomes a routine procedure. Automated platforms may require only daily inspections and regular maintenance. In the case of subsea completions, longer service intervals are possible.

Although offshore manpower requirements usually decline during production, as the focus of activity shifts to onshore locations, the process of bringing new fields into full

production requires additional drilling in the form of delineation drilling until the parameters of each new field are defined. When production declines, wells are periodically worked over (operation on a producing well to restore or increase production) to boost output.

Past and Present Production Activity

The Gulf of Mexico is, by far, the most productive of the OCS oil and gas leasing regions. Table 7 shows the contribution of the Gulf of Mexico OCS to the national oil and condensate production, and table 8 shows the Gulf gas production. As of December 31, 1981, oil/condensate and gas produced from the Gulf accounted for 94.3 and 99.8 percent of the national OCS production totals, respectively (Beasley, 1982, oral commun.). However, since 1972, oil production has declined each year. Gas production, thought to have reached its peak last year, is also expected to begin a noticeable decline. Figure 7 shows the historical Gulf of Mexico OCS oil and gas production. Figure 8 shows the 1981 oil production from the Gulf of Mexico OCS; figure 9 shows the 1981 gas production.

TABLE 7.—Contribution of Gulf OCS oil and condensate production

(Quantities of oil and condensate are measured in barrels.)

Year	Total national OCS	Total Gulf OCS	Gulf as a % of national	Total Louisiana OCS	Louisiana total as a % of national	Louisiana total as a % of Gulf	Total Texas OCS	Texas total as a % of national	Texas total as a % of Gulf
1954	3,342,230	3,342,230	100	3,342,230	100	100	0	0	0
1955	6,705,484	6,705,484	100	6,703,528	99.9	99.9	1,956	.03	.03
1956	11,014,532	11,014,532	100	11,001,248	99.9	99.9	13,284	.12	.12
1957	16,070,187	16,070,187	100	16,064,395	99.9	99.9	5,792	.04	.04
1958	24,769,037	24,769,037	100	24,769,037	100	100	0	0	0
1959	35,697,521	35,697,521	100	35,697,264	99.9	99.9	257	-	-
1960	49,665,989	49,665,989	100	49,665,891	99.9	99.9	98	-	-
1961	64,330,078	64,330,078	100	64,330,078	100	100	0	0	0
1962	89,736,582	89,736,582	100	89,733,099	99.9	99.9	3,483	-	-
1963	104,579,240	104,579,240	100	104,526,436	99.9	99.9	52,804	.05	.05
1964	122,500,126	122,500,126	100	122,495,173	99.9	99.9	4,953	-	-
1965	144,968,615	144,968,615	100	144,964,868	99.9	99.9	3,747	-	-
1966	188,714,070	188,714,070	100	187,831,472	99.5	99.5	882,598	.4	.4
1967	221,861,614	221,861,614	100	218,995,828	98.7	98.7	2,865,786	1.3	1.3
1968	268,995,890	266,936,001	99.2	263,825,359	98.1	98.8	3,110,642	1.2	1.2
1969	312,859,987	302,919,143	96.8	300,159,292	95.9	99.1	2,759,851	.9	.9
1970	360,646,168	335,658,540	93.1	333,411,492	92.4	99.3	2,247,048	.6	.7
1971	418,548,946	387,445,398	92.6	385,760,351	92.1	99.6	1,685,047	.4	.4
1972	411,885,893	389,323,680	94.5	387,590,662	94.1	99.6	1,733,018	.4	.4
1973	394,729,999	375,814,685	95.2	374,196,856	94.8	99.6	1,617,829	.4	.4
1974	360,594,065	343,817,321	95.3	342,435,496	95.0	99.6	1,381,825	.4	.4
1975	330,237,452	314,932,695	95.4	313,592,559	95.0	99.6	1,340,136	.4	.4
1976	316,920,109	302,941,556	95.6	301,887,002	95.3	99.7	1,054,554	.3	.3
1977	303,948,240	291,680,642	96.0	290,771,605	95.7	99.7	909,037	.3	.3
1978	292,265,042	280,179,134	95.9	278,071,535	95.1	99.2	2,107,599	.7	.7
1979	285,565,538	274,604,462	96.2	271,008,916	94.9	98.7	3,595,546	1.3	1.3
1980	277,388,975	267,190,089	96.3	256,688,082	92.5	96.1	10,502,007	3.8	3.9
1981*	286,567,354	270,160,378	94.3	255,875,717	89.3	94.7	14,284,661	5.0	5.3

(-) indicates less than .01 percent.

SOURCE: USGS, Conservation Division, 1981.

Mitchell Energy & Development Corporation of Houston started producing oil and gas from its Galveston Island Block 189 in September 1981. Initial production from Block 189 was 350 to 500 barrels (56-79 m3) of oil per day and about 3 million cubic feet (84,900 m3) of gas per day. Eight wells have been completed off Mitchell's platform, and additional wells are expected to be drilled to further develop the field (Oil & Gas Journal, 1981b).

Production of oil and gas from Shell Oil Company Group's Platform Cognac, on Mississippi Canyon Block 194, began early this year. Gas production, currently about 30 million cubic feet (849,000 m3) per day, is expected to reach 87 million cubic feet (2,462,100 m3) by the end of 1982. Production is projected to peak at 180 million cubic feet (5,094,000 m3) by 1990. Oil production, about 15,000 to 20,000 barrels (2,383-3,178 m3) per day currently, is expected to increase to about 45,000 barrels (7,150 m3) per day by the end of 1982 (Oil & Gas Journal, 1982e). Platform Cognac is the world's tallest working oil and gas platform at 1,265 feet (386 m), the world's heaviest working steel platform at 59,000 tons (53,519 metric tons), and the world's first three-part platform.

TABLE 8.—Contribution of Gulf OCS gas production

(Quantities of gas are measured in thousand cubic feet.)

Year	Total national OCS	Total Gulf OCS	Gulf as a % of national	Total Louisiana OCS	Louisiana total as a % of national	Louisiana total as a % of Gulf	Total Texas OCS	Texas total as a % of national	Texas total as a % of Gulf
1954	56,325,083	56,325,083	100	56,325,083	100	100	0	0	0
1955	81,279,042	81,279,042	100	81,279,042	100	100	0	0	0
1956	82,892,538	82,892,538	100	82,892,538	100	100	0	0	0
1957	82,573,604	82,573,604	100	82,568,807	99.9	99.9	4,797	.01	.01
1958	127,692,848	127,692,848	100	127,692,848	100	100	0	0	0
1959	207,156,296	207,156,296	100	207,156,296	100	100	0	0	0
1960	273,034,451	273,034,451	100	273,034,451	100	100	0	0	0
1961	318,280,095	318,280,095	100	318,280,095	100	100	0	0	0
1962	451,952,659	451,952,659	100	451,952,659	100	100	0	0	0
1963	564,352,606	564,352,606	100	564,352,606	100	100	0	9	0
1964	621,731,438	621,731,438	100	621,731,438	100	100	0	0	0
1965	645,589,469	645,589,469	100	645,589,469	100	100	0	0	0
1966	1,007,447,235	1,007,447,235	100	965,387,849	95.8	95.8	42,059,386	4.2	4.2
1967	1,187,215,750	1,187,215,750	100	1,087,262,804	91.7	91.7	99,952,946	8.4	8.4
1968	1,524,178,078	1,523,378,393	99.9	1,413,467,606	92.7	92.8	109,910,787	7.2	1.2
1969	1,954,486,975	1,949,641,124	99.8	1,822,544,142	93.2	93.5	127,096,982	6.5	6.5
1970	2,418,676,591	2,406,447,444	99.5	2,273,147,040	94.0	94.5	133,300,404	5.5	5.5
1971	2,777,043,418	2,761,371,939	99.4	2,634,014,031	94.8	95.4	127,357,908	4.6	4.6
1972	3,038,554,773	3,028,521,192	99.7	2,881,364.733	94.8	95.1	147,156,459	4.8	4.9
1973	3,211,588,422	3,204,301,873	99.8	3,055,628,236	95.1	95.4	148,673,637	4.6	4.6
1974	3,514,723,907	3,509,150,265	99.8	3,349,170,864	95.3	95.4	159,979,401	4.6	4.6
1975	3,458,693,454	3,454,741,821	99.9	3,332,169,057	96.3	96.5	122,572,764	3.5	3.5
1976	3,595,923,526	3,592,448,325	99.9	3,499,865,900	97.3	97.4	92,582,425	2.6	2.6
1977	3,737,746,922	3,734,456,959	99.9	3,647,513,674	97.6	97.7	86,943,285	2.3	2.3
1978	4,385,060,878	4,381,588,586	99.9	4,149,731,136	94.6	94.7	231,857,450	5.3	5.3
1979	4,672,979,139	4,670,112,317	99.9	4,158,521,710	89.0	89.0	511,590,607	10.9	11.0
1980	4,641,456,983	4,638,349,960	99.9	4,013,707,434	86.5	86.5	624,642,526	13.5	13.5
1981*	4,844,481,972	4,836,770,421	99.8	4,106,494,590	84.8	84.9	730,275,831	15.1	15.1

SOURCE: USGS, Conservation Division, 1981.

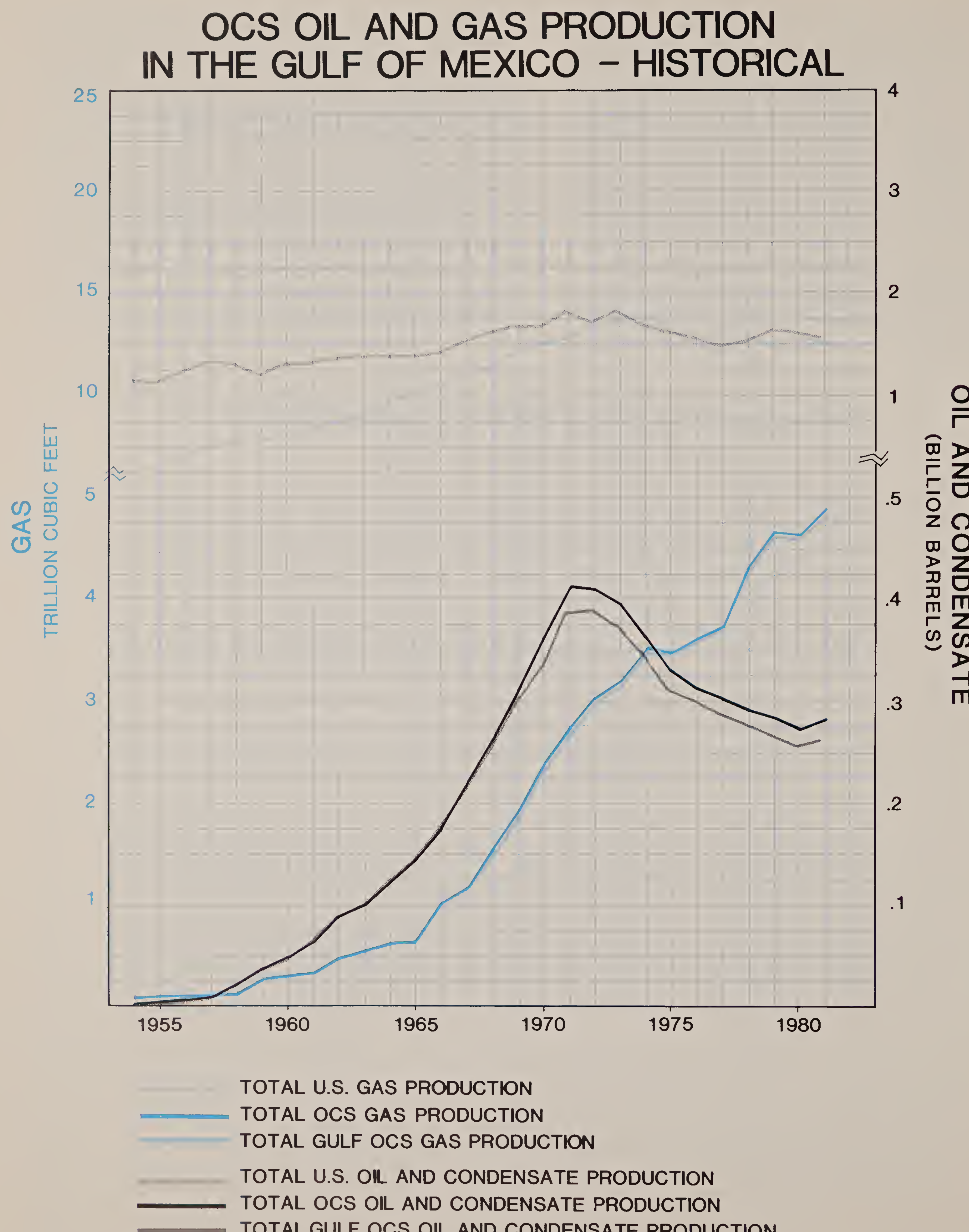


FIGURE 7.--Historical oil and gas production from the Gulf of Mexico OCS. (Adapted from USGS, Conservation Division, 1981, by Rogers, Golden & Halpern, 1982.)

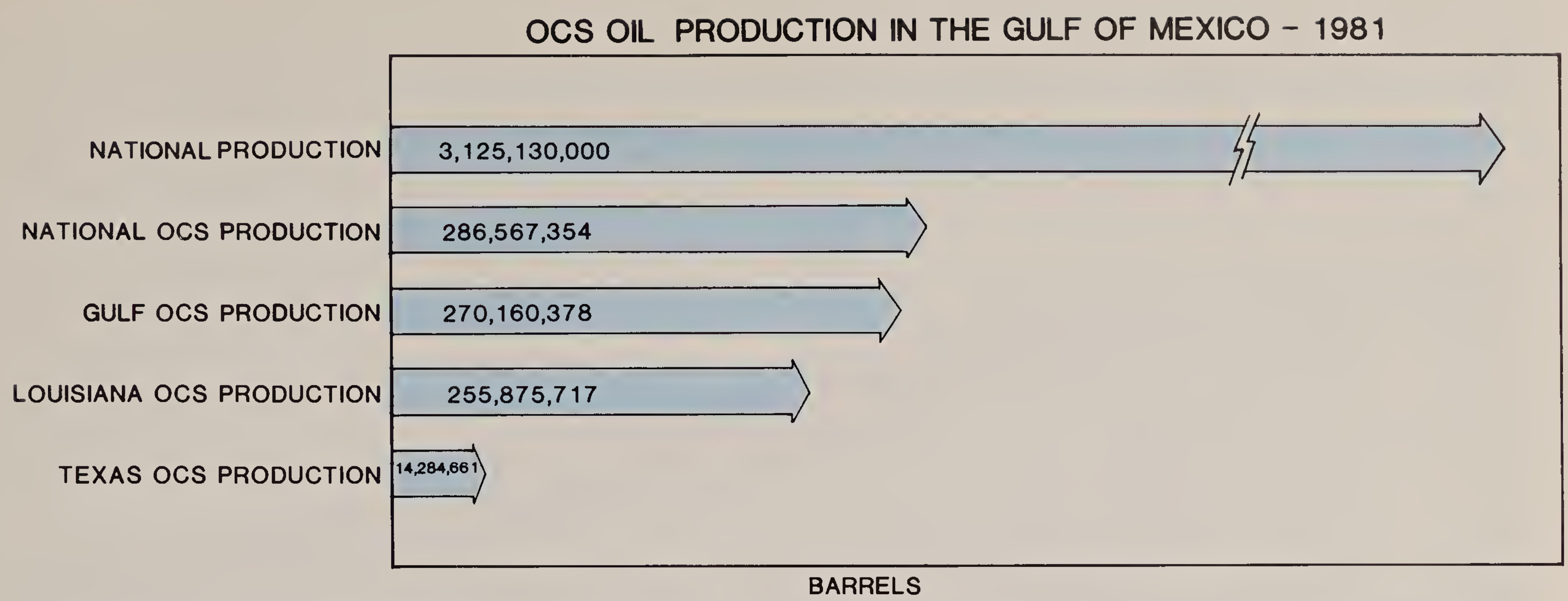


FIGURE 8.--Annual oil production from the Gulf of Mexico OCS. (Modified from USGS, Conservation Division, 1981, by Rogers, Golden & Halpern, 1982.)

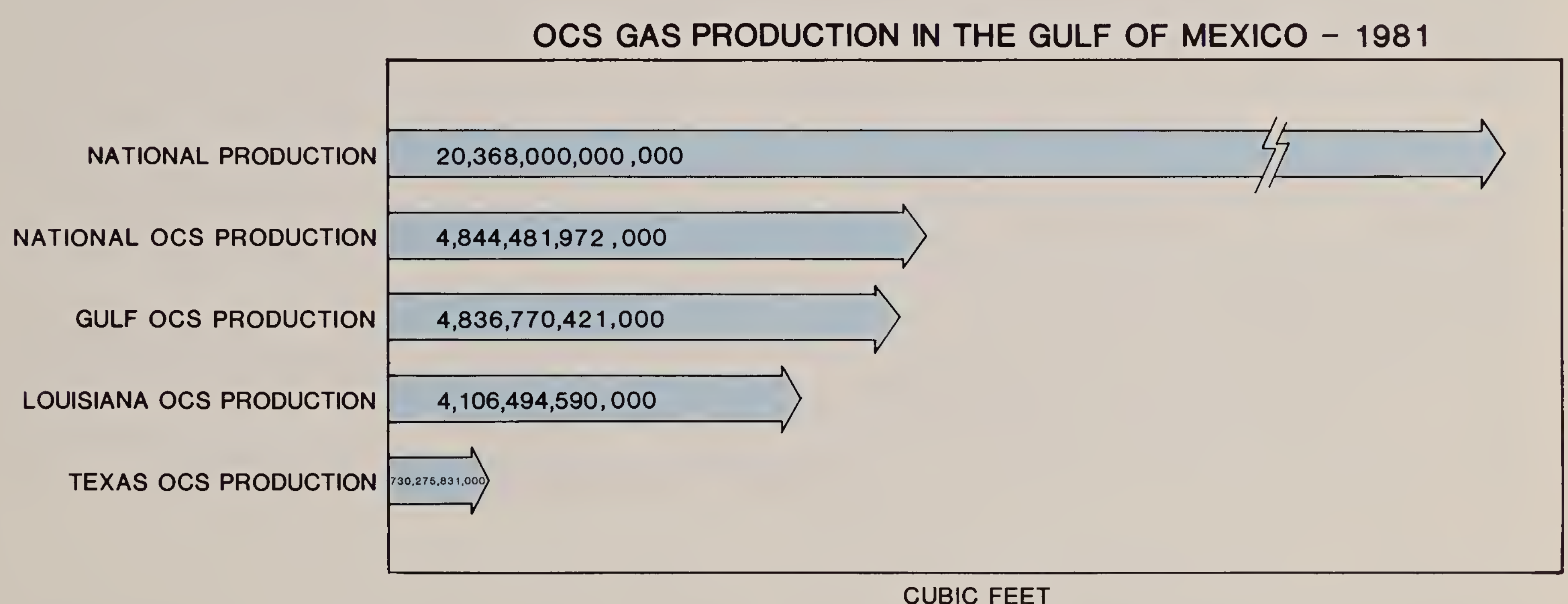


FIGURE 9.--Annual gas production from the Gulf of Mexico OCS. (Modified from USGS, Conservation Division, 1981, by Rogers, Golden & Halpern, 1982.)

Another technologically innovative deep-water platform, Union Oil Company's Platform Cerveza, has been installed in the East Breaks 160 field, located 100 miles (161 km) off Texas in waters 935 feet (285 m) deep. Cerveza's platform jacket is 952 feet (290 m) tall, and it was set in place in one piece. Initially, Cerveza will have 34 wells, but it will be able to accommodate another 6 wells. Drilling will be carried to multiple reservoirs 3,500 feet (1,067 m) and 10,500 feet (3,200 m) deep. Union, the operator, expects daily production at Cerveza to reach 25,000 barrels (3,972 m) per day of crude and 96 million cubic feet (2,716,800 m3) of gas per day by 1985 (Ocean Industry, 1981). Platform Cerveza is shown on the accompanying photograph.

ARCO Oil and Gas Company has recently begun producing natural gas at a rate of more than 100 million cubic feet (2,830,000 m3) of gas per day from five Gulf of Mexico platforms. Seven additional platforms, to go on line later this year, are expected to double ARCO's South Texas offshore district gas production to about 500 million cubic feet

Cerveza Ligera platform. (Photograph by Doug Slitor, MMS.)

(14,150,000 m3) of gas per day in 1984 from 245 million cubic feet (6,933,500 m3) of gas per day in 1981.

West Cameron Block 205 field, which began production on February 23, 1982, is currently producing 35 million cubic feet (990,500 m3) of gas per day and 300 barrels (48 m3) of oil per day. ARCO had indicated that more platforms will be installed to develop this field. A production rate of 90 million cubic feet (2,547,000 m3) of gas per day and 700 barrels (280 m3) per day is expected by the fourth quarter of 1982. This rate is projected to increase as more pipelines and platforms are installed. ARCO placed production platforms on West Cameron Blocks 249 and 601 and West Delta Block 63 in March 1982. These platforms have an estimated production rate of 60 million cubic feet (1,698,000 m3) of gas.

ARCO began producing gas from Platform A on North Padre Island Block 967 in

Cognac platform. (Photograph by Jeffrey Wiese, Rogers, Golden & Halpern.)

April 1982; anticipated rate of production from this platform is 12 million cubic feet (339,600 m3) of gas per day (Oil & Gas Journal, 1982e).

Depletion Phase

When production is no longer economically feasible, wells are plugged and fields are gradually abandoned. Onshore facilities are closed or put to other uses. Planning considerations are focused on finding alternative uses for facilities and alternative employment for workers formerly employed in OCS-related onshore activities. Local issues to be considered are adjustment to loss of revenues and maintaining the economic base.

When a field is depleted and abandoned, operators must plug their wells in the manner specified by OCS Operating Order No. 3. The Minerals Management Service monitors and enforces abandonment regulations. All oil and gas zones are isolated by the installation of cement plugs to ensure a permanent seal. All pipe casings must be cut off below the ocean floor and the well location cleared.

In the past, platform removal and field depletion have not been significant concerns in the Gulf of Mexico. But recently, with declining oil production and depletion of many fields that were discovered a number of years ago, planners must now consider impacts generated by these changes in productivity. While platform installations still outstrip platform removals by a wide margin, the reversal of this trend can be expected in the future. In 1981, 30 platforms were removed from the OCS. Figure 10 shows platform additions, removals, and net monthly gain since January 1978.

FUTURE EXPLORATION, DEVELOPMENT, AND PRODUCTION

According to the July 1982 final 5-year oil and gas leasing schedule, 12 sales are scheduled in the period from October 1982 through April 1987 in the Gulf of Mexico. One lease sale will be held each year in the western and central planning areas, and one lease sale will be held every 2 years in the eastern planning area, beginning with Lease Sale 72. The introduction identifies the dates of proposed Gulf of Mexico lease sales (pp. 2-3).

Exploration and development on the Gulf of Mexico will probably remain at the current level, with increased activity being seen as production begins to decline from mature fields. Smaller fields will become economically producible, and thus a large part of the future operations will center on these smaller fields. As oil production is expected to continue its present decline, and gas production is also expected to begin to decline in the near future, it is not likely that new discoveries of oil and gas will offset the dwindling supplies from established fields.

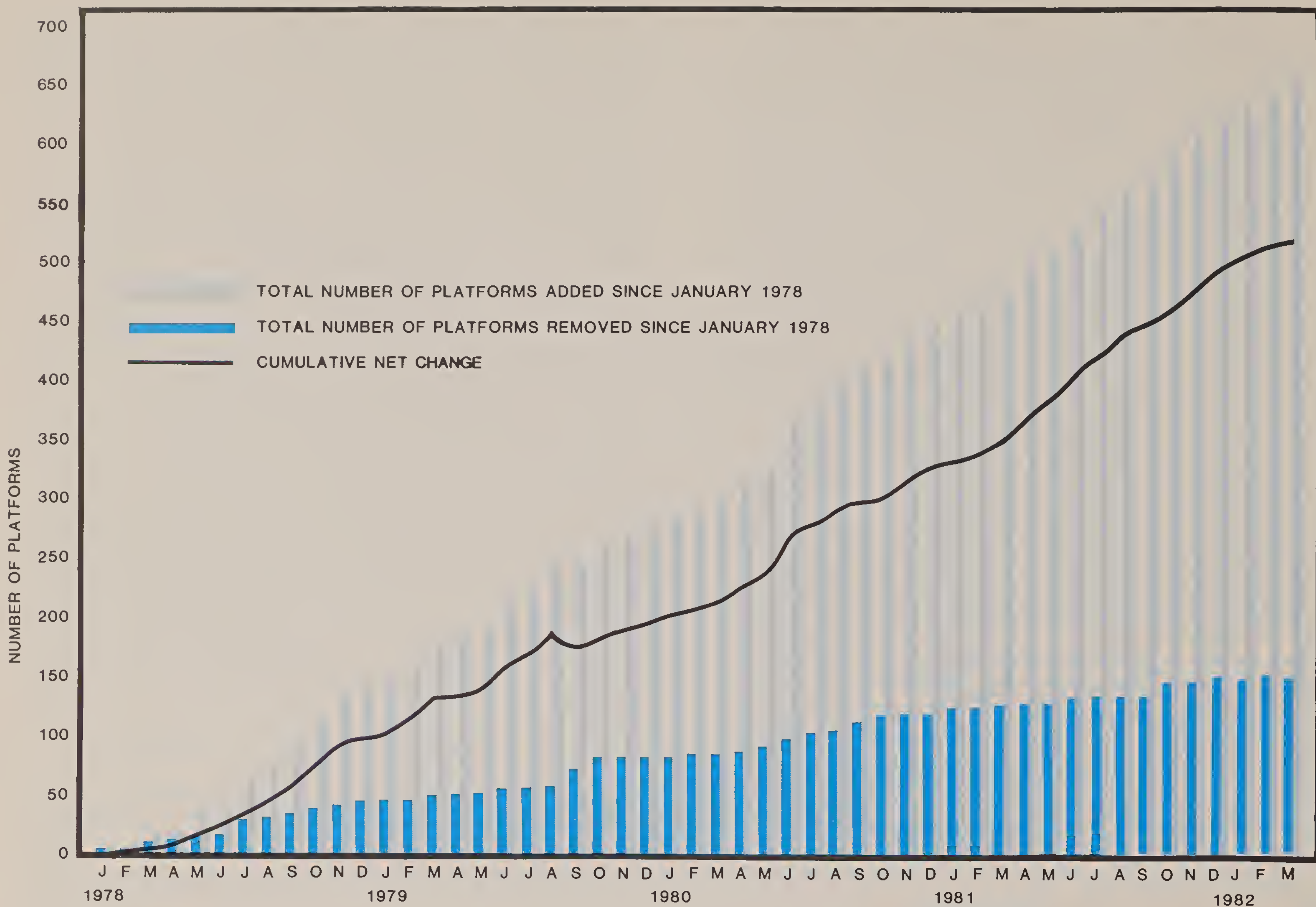


FIGURE 10.--Platform additions, removals, and net monthly change by month, January 1978 through March 1982. (Adapted from USGS Monthly Reports, January 1978 through March 1982, by Rogers, Golden & Halpern, 1982.)

Future exploraton will undoubtedly move into deepwater frontiers as industry's technological advances allow. Other areas that have not previously received much interest (South Texas and MAFLA offshore) may also gain industry attention. The stimulus of price decontrol and the use of more cost-effective technology will allow the development of fields formerly considered marginal.

Implementation of secondary and tertiary recovery techniques will make it possible to extract more oil and gas from reservoirs than was ever possible before. However, unless more and larger discoveries result from future exploration efforts (a prospect that is not likely), ultimate depletion of Gulf of Mexico OCS hydrocarbon reserves is probable sometime after the year 2000, given current production rates.

EFFORTS TO STREAMLINE AND ACCELERATE OCS LEASING

The Department of the Interior approved the 5-year OCS oil and gas leasing program on July 21, 1982. The leasing program, which had been under review for 19 months, was submitted to the President and the Congress for final approval in May 1982. Review of the 5-year OCS leasing program is an annual exercise that is mandated by section 18(e) of the OCS Lands Act, as amended. The new leasing

schedule covers the period from August 1982 through June 1987. The revised program contains changes that will accelerate OCS leasing. The purpose of the changes is to facilitate exploration and development by making high-quality prospective hydrocarbon-bearing acreage available earlier and more frequently than under the previous program.

The July 1982 final 5-year OCS oil and gas leasing schedule contains 41 lease sales. The schedule calls for 12 offerings in the Gulf of Mexico: 1 remaining in 1982, 3 in 1983, 2 in 1984, 3 in 1985, 2 in 1986, and 1 in 1987. The Gulf of Mexico is divided into three planning areas. They are the western, central and eastern Gulf, containing 36 million acres (14,569,200 hectares), 46 million acres (18,616,200 hectares), and 58 million acres (23,472,600 hectares), respectively. Under the new schedule, each planning area will be offered for lease each year, except the eastern Gulf, which will only be offered in the alternating years 1983 and 1985. Plate 1 shows the extent of the planning areas.

Acceleration of offshore leasing will be accomplished in two ways: the first is by increasing the amount of acreage offered in each lease sale, and the second is by conducting more frequent lease sales within the 5-year period covered by the leasing schedule. These acceleration procedures and the accompanying streamlined pre-lease procedures will be fully implemented by 1983.

The purpose of streamlining is to accommodate the accelerated leasing effort without sacrificing the essential elements of the environmental analyses. Procedural streamlining that is occurring with adoption of the new 5-year leasing program is designed to reduce the time required for performance of pre-lease procedures from 42 months to 21 months.

Procedural streamlining revamps five major pre-lease steps. The new steps are called the call for information, area identification, National Environmental Policy Act of 1969 (NEPA) document preparation, issuance of proposed notice of sale, and final notice of sale.

The Department of the Interior's principal streamlining efforts have been directed toward the pre-lease procedures. The Department of the Interior has also decided to revise evaluation procedures to ensure fair market value for OCS leased lands and the rights conveyed. One of these steps will shift final tract evaluations from the pre-lease to the post-lease period. This will result in a system that relies more extensively on competition in the lease market while employing less extensive and more efficient tract evaluation procedures. This shift will also allow for the development and validation of new evaluation techniques and for adjustment of tract evaluation efficiency in response to emerging patterns of competition and bidding. The decision to shift to post-lease tract evaluation is intended to reduce the total tract evaluation effort by eliminating work on tracts within the entire planning area that received no bids.

At least two options have been under discussion within the Department of the Interior as a means to streamline post-sale permitting procedures through changes in regulations. The first would involve revisions to 30 CFR 250.34 to explicitly allow for development and production in the western Gulf of Mexico without the requirement for submittal of a plan of development/production. A notice of proposed rulemaking regarding submittal of POD/P's was published in the Federal Register on October 6, 1981. The proposed rule has been sent to the Office of the Assistant Secretary for Energy and Minerals, where it awaits approval as of this writing (Schuenke, 1982, oral commun.). The second option would require revisions to the Environmental Protection Agency's National Pollutant Discharge Elimination System regulations to set time frames for issuance. Neither option has been approved as of this writing.

The recent reorganization within the U.S. Geological Survey and the Bureau of Land Management and the emergence of the Minerals Management Service has resulted in some anticipated administration and policy shifts. To date, the Minerals Management Service has assumed all of the functions previously executed by the Conservation Division of the U.S. Geological Survey. According to Secretarial Order No. 3071, Amendment 2, the Minerals Management Service is also functioning in direct support of the OCS program, which at a minimum called for the following:

- all functions of the Office of OCS Program Coordination;

- all functions related to the management of offshore energy and minerals administered by the Bureau of Land Management;

- all functions in direct support of the OCS program in the Geologic Division and the Office of the Assistant Director for Resource Programs, U.S. Geological Survey, including offshore oil and gas resources, energy-related hazards, and marine geology investigations;

- oil-spill trajectory analysis functions of the Office of Earth Science Applications;

- all functions of the Office of Policy Analysis relating to scheduling the sale of leases of OCS land; and

- all functions relating to the OCS program transferred from the Department of Energy as a result of the Interior and Related Agencies Appropriation Act, FY 1982 (P.L. 97-100).

The Minerals Management Service will implement new policy and guidance developed by the Minerals Management Board, its administrative overseer.

The Minerals Management Service consists of the following major functional components: Office of the Director; Royalty Management; Onshore Minerals Operations; Offshore Minerals Management; Program Review; and Administration. Administration includes all related administrative support services and certain executive direction functions formerly with the U.S. Geological Survey and the Bureau of Land Management.

Summary

The central and western Gulf of Mexico is a mature oil- and gas-producing region, with a fully developed onshore support infrastructure. In the likely event of a decline in Gulf OCS production, imported oil may be substituted for dwindling domestic stocks at Gulf Coast refineries. Thus, the onshore support structure will most likely be supplied by some mix of domestic and foreign oil and gas supplies for the foreseeable future. In addition to these supplies, any increase in the level of OCS exploration and production in response to declining production in discovered fields will help keep onshore support industries in business.

Although the long-range outlook is for an increased pace of exploration and development, it is the position of the Department of the Interior and the oil and gas industry that the availability of drilling rigs will not pose a constraint to offshore exploration and development under the July 1982 final 5-year OCS oil and gas leasing schedule. The pace of offshore exploration and development activity will increase as drilling rigs become available. The demand for additional drilling rigs for Gulf of Mexico operations, as well as oil exploration worldwide, should result in more intense onshore activity in selected Gulf Coast centers, particularly where platform fabrication yards, pipe coating yards, and related industries are located.

3. OCS Oil and Gas Transportation Strategies

While oil and gas produced offshore may undergo preliminary separation and treatment at the platform, they must ultimately be transported to shore for additional processing and refining. In the Gulf of Mexico, 98 percent of the oil and gas produced is transported to shore in pipelines; the remaining 2 percent arrives ashore via barges or tankers.

Federal authority for pipeline routing and operations on submerged Outer Continental Shelf (OCS) lands is vested in several agencies:

- Department of the Interior, Minerals Management Service--pipelines on the OCS that leave a leasehold, and rights-of-way for pipelines on the OCS wholly contained within the confines of a single lease, adjoining leases, or unit area.

- U.S. Army Corps of Engineers--issues permits for construction, including pipelines on the OCS and other navigable waters; navigation is their principal concern.

- Federal Energy Regulatory Commission--grants "Certificates of Convenience and Necessity" prior to construction of projects involving transport or sale of interstate natural gas and must investigate environmental effects, potential reserves, demand for the gas, and available capital to develop the resource.

- Interstate Commerce Commission--grants approval of the tariff rates for transporting oil by common-carrier pipelines.

- Department of Transportation, Office of Pipeline Safety--establishes minimum standards for pipeline construction, operation, and maintenance (BLM, New Orleans OCS Office, 1981b).

EXISTING AND PROPOSED TRANSPORTATION STRATEGIES

Pipeline Transportation

Offshore pipeline transportation consists of a network of (1) gathering lines, which collect hydrocarbons from scattered fields or platforms and carry them to a central location for storage, metering, and preliminary treatment, and (2) transmission lines, which move the collected oil and gas to shore points. At the present time, 56 major pipeline networks carry hydrocarbons produced offshore to their onshore destinations. **Plate 3** shows major pipeline routes and known proposed pipelines and extensions.

Each year, hundreds of miles of pipelines are added to the already extensive pipeline network in the Gulf of Mexico. For the most part, these additions are sections of small-diameter gathering or feeder lines, linking new platforms to a major pipeline system or adding to the capacity of the system by running a new line parallel to the existing trunkline. Pipelines may be added to connect major systems,

allowing diversion of hydrocarbons from one major system to another, or eliminating bottlenecks by balancing the flow of oil or gas through the lines. Discussion of proposed pipelines in this summary report is limited to significant projects.

SOS AND TOPS. Two competing proposals, one by Seagull Pipeline Corporation (Seagull Offshore System (SOS)), and the other by Corpus Christi Oil & Gas (Tarpon Offshore Pipeline System (TOPS)), have been developed to span the Texas coastline to transport new gas production to shore. The Seagull project has been granted all necessary government approvals, and the company has a 3-year period in which to build the system or seek an extension for the project. The Seagull line, as designed, will be 258 miles (415 km) long and 24 inches (61 cm) in diameter, ranging from State Tract 1078-L northwest of Brownsville, Texas, north to State Tract 182-S off the Bolivar Peninsula.

The TOPS proposal calls for construction of a 250-mile (402-km), 24-inch (61-cm) line that would carry as much as 400 million cubic feet (11,320,000 m3) of gas per day from a location near Port Isabel, Texas, to a connection with existing lines off Galveston, Texas.

Only one of the projects is likely to be completed, and early construction will probably be in segments. **Plate 3** shows the location of these proposed pipeline projects.

CTGS AND HIOS. The Transcontinental Pipeline Company (Transco), operator for a group of companies, plans a $142.1 million expansion of its offshore Central Texas Gathering System (CTGS) in the Gulf of Mexico. Another Transco project planned off Texas will increase capacity of the company's High Island Offshore System (HIOS). Transco has applied to the U.S. Army Corps of Engineers and the Federal Energy Regulatory Commission (FERC) for construction permits.

The CTGS expansion project will increase capacity to 1.9 billion cubic feet (53,770,000 m3) of gas per day from the present 369 million cubic feet (10,442,700 m3) of gas per day to handle dedicated reserves expected to be available from Brazos, Mustang Island, Galveston, and Matagorda Island offshore blocks. Laying of 30-inch (76-cm) and 36-inch (91-cm) line, to take place in two phases, will begin as soon as FERC permits are granted. The project, which includes measuring and regulating facilities at Transco's Markham processing plant in Matagorda County, Texas, is scheduled for completion in November 1983.

The HIOS extension involves laying about 11 miles (18 km) of 20-inch (51-cm) pipeline and two 12-inch (30-cm) lines totaling about 2-1/2 miles (4.0 km).

The 20-inch (51-cm) line will extend from High Island South Addition Block A-539 to High Island South Addition Block A-568. It will tie in planned production from area blocks to the western leg of Transco's 30-inch (76-cm) HIOS pipeline.

One 12-inch (30-cm) line, totaling about 1.85 miles (3.0 km), will tie in an existing Mesa Petroleum Company platform in Block A-567 to the proposed 20-inch (51-cm) line in Block A-552. Seven development wells have been completed, and the platform is scheduled to begin production in the fourth quarter of 1982.

The other 12-inch (30-cm) line, about 0.66 miles (1.1 km) in length, will link Transco's proposed Platform A in Block A-552 to the planned 20-inch (51-cm) main line.

HIOS gas is transported ashore to Johnson's Bayou, Louisiana, for processing (Oil & Gas Journal, 1982b).

SONAT'S COGNAC LINE. The Southern Natural (SONAT) pipeline connecting the Shell Oil Company Group's Cognac platform to SONAT's Romere Pass line in Plaquemines Parish, Louisiana, began transporting gas early in 1982. In waters ranging from 17 to 1,025 feet (5.2-312 m), the 39-mile (63-km), 16-inch (41-cm) and 18-inch (46-cm) pipelines are the deepest subsea lines in the Western Hemisphere. Gas production from Platform Cognac, in Mississippi Canyon Block 194, was about 30 million cubic feet (849,000 m3) of gas per day as of April 19, 1982. It is expected to increase to about 87 million cubic feet (2,462,100 m3) of gas per day by the end of the year. Gas production is projected to reach 180 million cubic feet (5,094,000 m3) of gas per day by 1990 (Oil & Gas Journal, 1982e).

Oil production from Cognac is carried in a 12-3/4-inch (32-cm) line to a connection with

a line in South Pass Block 25. This line was laid in 1979 by McDermott, Incorporated's marine pipeline division.

Vessel Transportation

Two percent of the oil produced on the Gulf of Mexico OCS is brought to shore on barges or tankers. Because of the greater possibility of groundings or collisions with other vessels or offshore structures, this mode of transportation is less desirable than pipeline transportation.

Another method by which crude oil is transported to shore is called lightering. This method, generally used for imported oil, involves offloading large tankers at sea outside ports to smaller vessels, which then travel to a discharge point. Tankers can lighter their entire cargo, or, when enough oil has been lightered to allow a tanker to draw less water, the ship can proceed to a refinery terminal to discharge the remaining cargo. Lightering is a common practice at entrances of Gulf ports that are too shallow to handle deep-draft vessels. This offloading activity can take place without docking or mooring the tankers. Lightering activities are regulated by the U.S. Coast Guard Captains of Ports, who have the authority to grant lightering permits.

DEEPWATER PORTS AND TRANSSHIPMENT TERMINALS. Deepwater ports and transshipment terminals are designed to accommodate supertankers, the huge vessels that carry large quantities of crude oil over long distances. The draft requirements of these vessels call for water depths of up to 100 feet (30 m). Most conventional ports are limited in depth and thus cannot service supertankers. Deepwater ports are usually located some distance offshore and consist of either a fixed island pier or some type of floating mooring system.

Tankers offloading at deepwater ports or transshipment terminals transfer crude oil to storage tanks or other vessels. The crude is subsequently distributed to other storage tanks or refineries.

In the past few years, there have been a number of proposals for deepwater ports and transshipment terminals, as well as for projects involving deepening or widening of existing conventional ports.

Gulf Coast Transshipment Terminal. Coscol Marine Corporation, a subsidiary of Coastal Corporation, has proposed the construction of a lightering station in waters off Corpus Christi, Texas. Coscol filed its initial application for construction of the facility, to be called the Gulf Coast Transshipment Terminal, in July 1979. The proposal calls for a three-monobuoy station located on the Outer Continental Shelf, in 120 feet (37 m) of water about 25 miles (40 km) southeast of Corpus Christi. The system was designed to handle 125,000 to 200,000 barrels (19,862-31,780 m3) of crude oil per day, lightered from large and very large crude carriers. One purpose of the system was to permit safer lightering operations than that now taking place off Corpus Christi, Texas; the proposed lightering system could be operated under a greater range of weather conditions.

Although the proposal has received Mineral Management Service and U.S. Army Corps of Engineers permits needed for construction to proceed, Coscol's plans have been delayed, largely due to current low refinery utilization rates in the United States. Coscol had planned to use the lightering facility to serve the needs of Coastal's 185,000 barrel (29,396 m3) per day Corpus Christi refinery and its 30,000 barrel (4,767 m3) per day Wichita, Kansas, refinery. This was before throughput at the Corpus Christi refinery dropped to about 45 percent of capacity. Coscol alone does not now need the lightering facility, but if the company can attract partners who may require a similar service, the lightering station could once again prove commercially attractive. No final decisions have been made as to the disposition of the project.

LOOP. In August 1977, the Louisiana Offshore Oil Port consortium (LOOP, Inc.) accepted Federal and State licenses to build the country's first deepwater oil port. The consortium is composed of five companies: Ashland Oil, Marathon Pipeline Company, Murphy Oil Corporation, Shell Oil Company, and Texaco, Inc.

LOOP began operations on May 1, 1981, as a common-carrier crude oil transportation

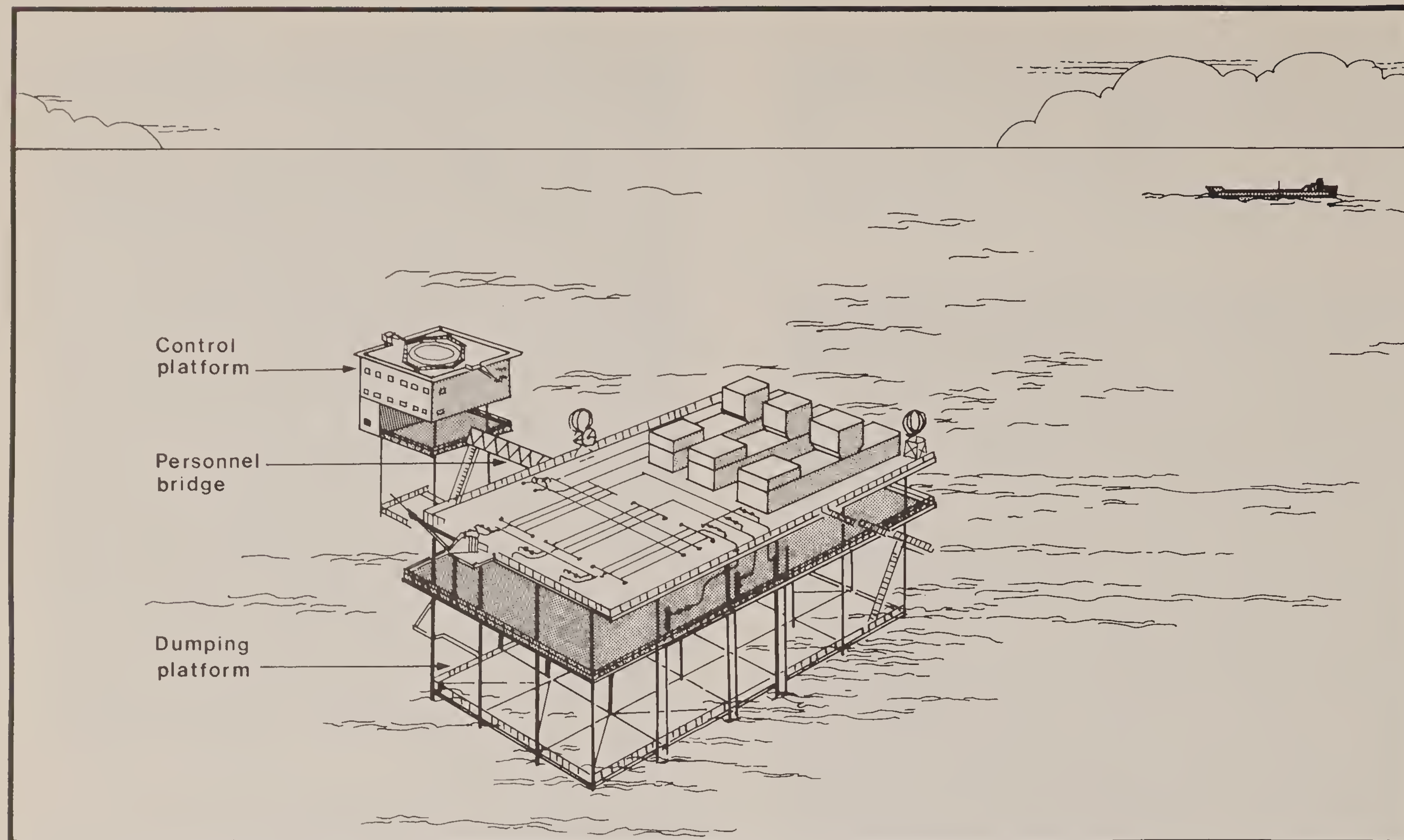


FIGURE 11.--LOOP offloading and transportation facilities. (Redrafted from LOOP, Inc., 1982, by Rogers, Golden & Halpern, 1982.)

facility. The LOOP marine terminal and platform complex is located about 19 miles (31 km) off Louisiana, in Grand Isle Blocks 52 and 59, in 110 feet (34 m) of water. The terminal/platform complex consists of a pump platform, a control platform, and three single anchor leg mooring (SALM) buoys. Figure 11 depicts the LOOP offloading and transportation facilities.

When a tanker arrives 5.0 miles (8.0 km) from the unloading complex, it is boarded by a specially trained mooring master, who guides the ship to its berth--one of the three SALM's. The ship is moored to the buoy by bow lines, and thus is free to rotate around the SALM in a 360-degree circle. This type of mooring system allows the tanker to maintain a heading of least resistance to wind and waves during the offloading operations.

Two parallel strings of flexible, floating hoses, each approximately 1,050 feet (320 m) long, are employed to connect the ship's cargo manifold with the fluid swivel unit on the single-point mooring base assembly. The tanker's pumps then begin to transfer the cargo.

The oil is pumped from the cargo manifold through the hoses to the fluid swivel base assembly and then into a 56-inch (142-cm) diameter submarine pipeline. This pipeline extends 8,000 feet (2,438 m) from the buoy's base to the LOOP pumping platform complex. When the oil reaches the platform, it is "boosted" to shore by three pumps connected in parallel, driven by 7,000-horsepower electric motors. This pumping system is capable of moving oil at rates of up to 100,000 barrels (15,890 m3) per hour. Connecting the pumping platform with LOOP's onshore facilities is a 48-inch (122-cm) submarine pipeline. When the oil reaches the shore, it continues inland for 28 miles (45 km) to the Clovelly Salt Dome Storage Terminal for temporary storage. During a 2-week period, the oil will leave storage and will either be pumped to refineries in Louisiana and Texas or sent up the Capline system to refineries in the Midwest. Current plans include five connecting carriers, or dis-

tributing pipelines, tied into the LOOP storage area. The pipelines, their owners, and their capacities are: LOCAP, Ashland Oil, Inc., Marathon Pipe Line Company, Shell Pipe Line Corporation, and Texaco, Inc., 55,000 barrels (8,739 m3) per hour; Shell Pipeline, Shell Pipe Line Corporation, 12,300 barrels (1,954 m3) per hour; Exxon Pipeline, Exxon Pipe Line Company, 7,500 barrels (1,192 m3) per hour; Texaco-Cities Service Pipeline, Texaco-Cities Service Company, 15,200 barrels (2,415 m3) per hour; and the CAM Pipeline, Gulf Oil Company, Murphy Oil Corporation, 12,600 barrels (2,002 m3) per hour.

LOCAP and the Exxon Pipeline received oil during LOOP's test and checkout period. The Texaco-Cities Service Pipeline is in service; the Shell Pipeline is available for service; and the CAM Pipeline is projected for service by mid-1982.

LOOP's deepwater port and support facilities have a design capacity of 1.4 million barrels (22,460 m3) of throughput per day. Approximately half of the crude oil will be shipped to Louisiana refiners. The balance will go to refineries in the Midwest and Texas. Crude oil for the LOOP deepwater port is expected to come from Saudi Arabia, Nigeria, Kuwait, Egypt, Qatar, Abu Dhabi, Algeria, Oman, Libya, and the North Sea. Bill Read, LOOP President, estimates that approximately 330 ships will unload at the facility during its first year of full operation, from mid-1982 to mid-1983 (LOOP, Inc., 1982).

LOOP is currently operating at about 25 percent capacity (200,000 to 300,000 barrels (31,780-47,670 m3) per day). LOOP is presently handling an average of seven or eight tankers per month, but officials predict that it will receive a tanker every 1-1/2 days when in full operation (Oil & Gas Journal, 1982f).

Texas Offshore Port. The Texas Oil Port Consortium, composed of Phillips, Dow Chemical, Continental Pipeline, and Seaway Pipeline Company, has proposed construction of a $191 million deepwater port in 71-foot (22-m) waters, 12 miles (19 km) off Freeport, Texas.

Project design calls for a single-point mooring terminal capable of offloading as much as 500,000 barrels (79,450 m3) of crude per day. It could accommodate fully loaded supertankers of 200,000 deadweight tons and tankers up to 350,000 deadweight tons if they were not fully loaded. Crude would be pumped to an onshore storage facility via a 56-inch (142-cm) diameter pipeline. From Freeport, oil would be transported to a major pipeline junction at Cushing, Oklahoma, and from there to major refineries in the midsection of the country.

The Texas Oil Port Consortium has been granted a construction permit by the Department of Transportation. The permit was to be accepted by the Consortium by June 21, 1982. The Consortium requested and was granted a 60-day extension from this date, and it has requested a 2-year extension of the license acceptance period (Tetley, 1982, oral comm.). Once the license is accepted and work proceeds, construction of the facility could be completed in about 5 years following licensing. The Texas Oil Port would be the second deepwater port in the United States. As of February 8, 1982, however, the Texas Offshore Port project has been shelved because of the current crude surplus and reduction in demand for petroleum products. A separate but similar project that has been undertaken by the Port of Freeport, Texas, involves deepening Freeport Channel to 45 feet (14 m) from the present 36 feet (11 m), and widening it to 400 feet (122 m) from the present width of 200 feet (61 m). The safety of vessel traffic is the main factor behind this project.

Pelican Island. Pelican Island, a $300 million project planned by Pelican Terminal (a consortium of Northville Industries, Chicago Bridge & Iron and Phillip Brothers) and Galveston Wharves, appears to be nearing the start of construction.

The project calls for construction of an oil terminal, and dredging the Galveston ship channel to a depth of 54 feet (16 m) within the jetties and inside the channel as far as the oil terminal. In addition, a new offshore channel 56 feet (17 m) deep and 600 feet (183 m) wide would be dredged. The offshore channel would extend 22 miles (35 km) into the Gulf of Mexico from the sea buoy and would allow offloading of tankers at the onshore oil port.

The Pelican Terminal consortium members anticipate getting the project under way this summer. The earliest date on which

tankers could call at the port would be December 1983 (Offshore Construction Report, 1982).

Deeport. A planned onshore oil port, called Deeport, to be constructed at Harbor Island off Aransas Pass bar has been in the planning stages since 1973. Planned facilities consist of two docks and a docking base in the turning basin in Lydia Ann Channel, a natural channel between San Jose Island and Harbor Island, capable of simultaneously accommodating two fully loaded 275,000 deadweight-ton tankers. Design calls for three very large crude carriers (VLCC's) to be accommodated, and present plans call for a tanker to be offloaded every other day.

Offloading facilities include a typical oil dock, a loading or working platform, and four structures for mooring lines of vessels to shore. There would be either three or four pipelines on the dock leading to storage tanks onshore.

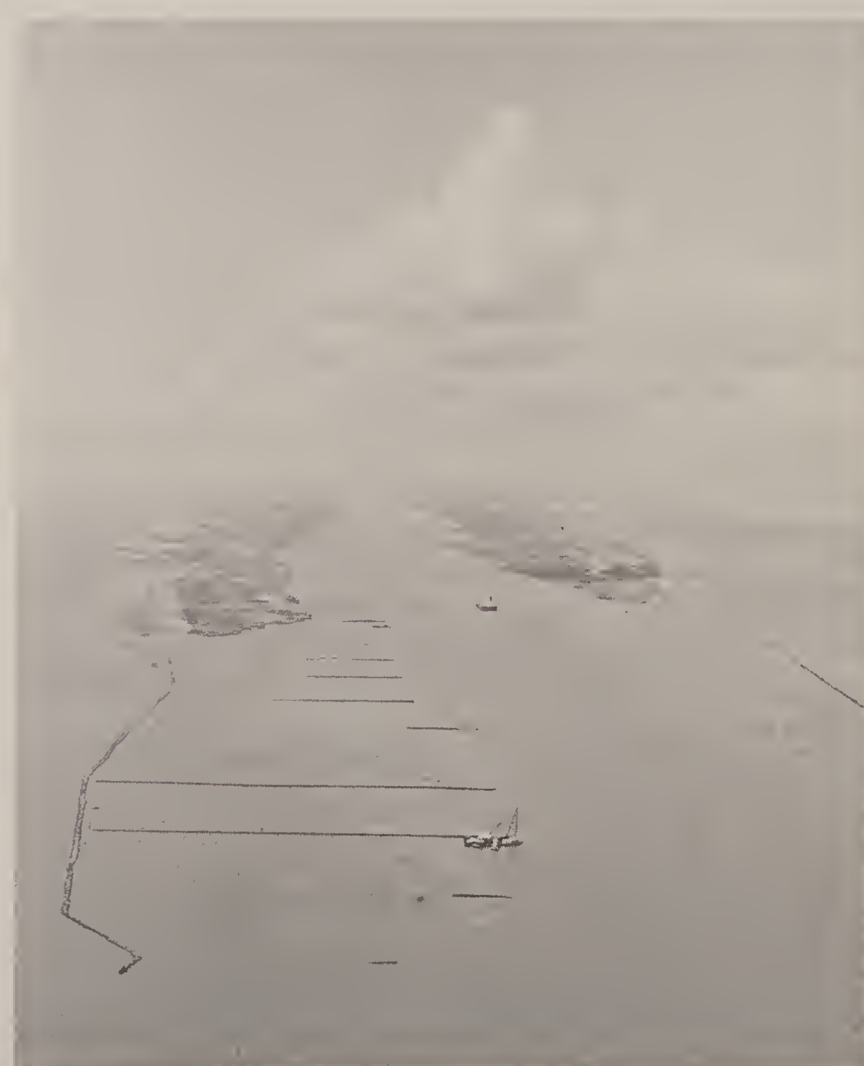
Original plans set the opening date for Deeport in 1977, but progress has been slowed over the years by requirements for additional environmental studies and high interest rates for construction.

Other Projects. A design has been proposed by architect Wayne Manuel of Lake Charles, Louisiana, for a harbor to be built in 55 feet (17 m) of water in West Cameron Block 197, which lies 30 miles (48 km) south of Cameron, Louisiana. The design of an offshore harbor facility has been seen as one answer to the increasing problem of congestion at conventional shoreside service facilities. The facility would include living units for 60 harbor personnel, as well as space for U.S. Coast Guard and medical stations, and helipads.

The harbor would have room for 200 berths. Designed dock space is 5,200 linear feet (1,585 m), and it includes commercial and resort dockage, and fuel and repair docks. Figure 12 shows the general location and plan of the Gulf Coast harbor.

SHIPPING SAFETY FAIRWAYS AND ANCHORAGES. Fairways and anchorage areas are established to control the erection of structures therein, to provide safe approaches through oil fields in the Gulf of Mexico to entrances to the major ports along the Gulf Coast. A shipping safety fairway is a designated area of a waterway where erection of fixed structures is prohibited. Fairways increase navigation safety by ensuring the availability of an obstruction-free route to vessel traffic transiting the vicinity. The U.S. Army Corps of Engineers requires permits for work or structures in the Gulf of Mexico's coastal waters and the waters overlying its Outer Continental Shelf. The erection of structures is not permitted in the areas designated as fairways, as structures located there would constitute obstructions to navigation.

The existing shipping safety fairways in the Gulf of Mexico are described in 33 CFR 209.135. They were established under the Outer Continental Shelf Lands Act (67 Stat. 463; 43 U.S.C. 1333(e)). Through the OCS



Fairway entrance to Main Pass, Mississippi River. (Photograph by Jeffrey Wiese, Rogers, Golden & Halpern.)

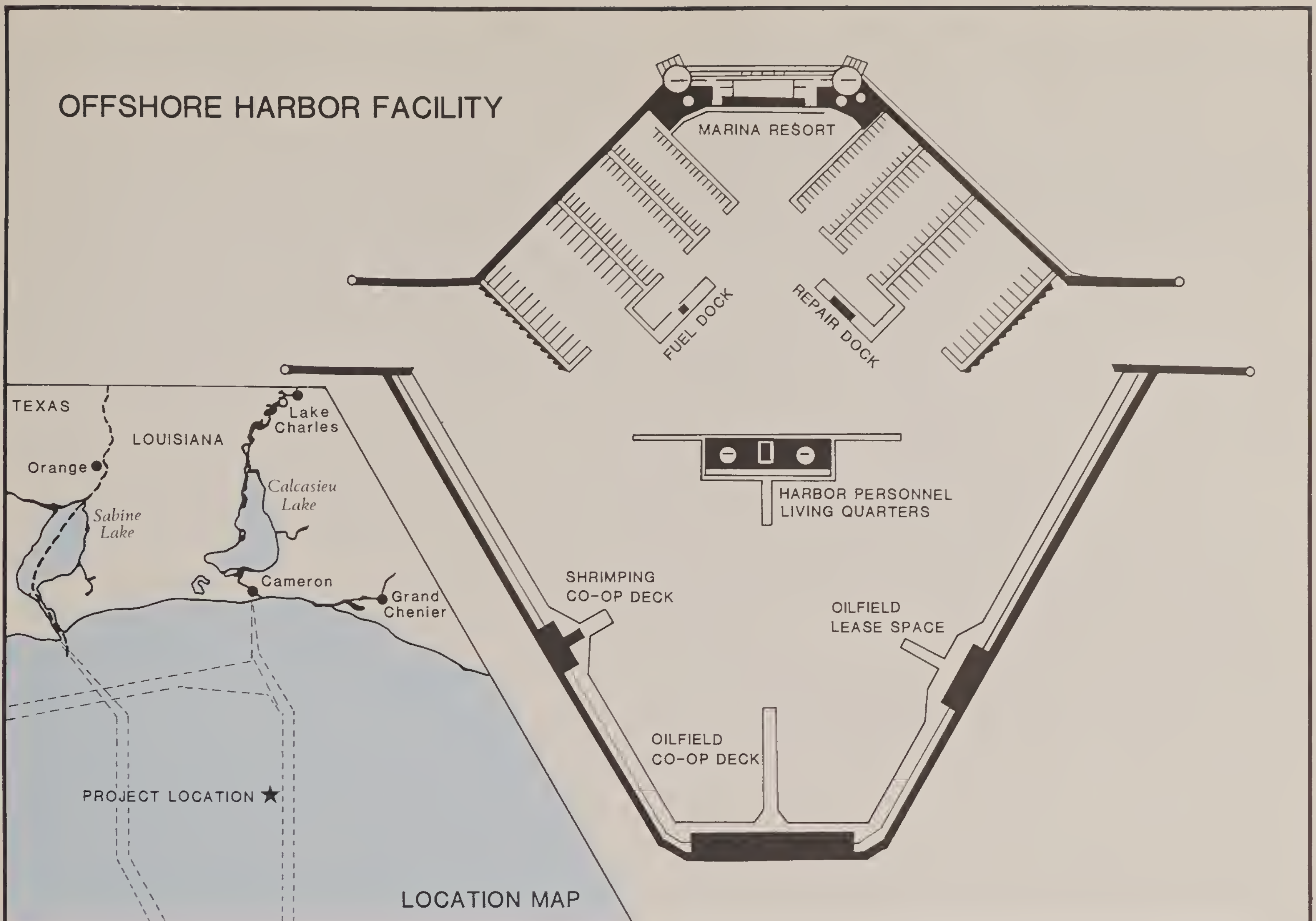


FIGURE 12.--Gulf Coast offshore harbor facility concept. (Redrafted from Offshore, 1982, by Rogers, Golden & Halpern, 1982.)

Lands Act, the U.S. Army Corps of Engineers was given authority to issue permits for structures on the OCS. In the interests of safe navigation, the Corps promulgated regulations to designate specific areas in which no permits would be issued.

In the Gulf of Mexico, there are over 800 miles (1,287 km) of fairways that are 2 miles (3.2 km) wide, some of which extend over 100 miles (161 km) into the Gulf. They were established by the Corps between 1948 and 1968 (with a few subsequent amendments) to reduce the risk of collision between vessels and the growing number of offshore structures. Many interests, including oil companies, maritime associations, shipping companies, and government agencies, participated in the development of the current fairway system.

In 1978, the Ports and Waterways Safety Act (PWSA) was amended to delegate authority to the Department of Transportation and the U.S. Coast Guard to establish vessel routing measures, including fairways and fairway anchorages. The PWSA authority to establish vessel routing measures was to be exercised only after a study into the need for designated safe access routes because of traffic density and use conflict.

The mandated study was initiated on April 16, 1979, and modified on January 31, 1980. Study results for the ports along the Gulf Coast were published in the Federal Reg-

ister on October 8, 1981. The study for this region found strong public support for the current system of fairways in the Gulf of Mexico and recommended that the existing Corps of Engineers fairways be adopted under the PWSA authority. No major widening or lengthening of the fairways was proposed. **Plate 3** shows shipping safety fairways and anchorages in the Gulf of Mexico.

Due to the international oil surplus, some oil companies are being forced to use their tankers as offshore storage vessels, which cruise slowly outside major ports awaiting offloading. As of September 1, 1981, there were at least 35 tankers in the Gulf of Mexico-Caribbean area. This use of tankers as storage vessels is causing additional congestion around major ports in the Gulf and Caribbean (Oil & Gas Journal, 1981a).

INTERGOVERNMENTAL PLANNING PROGRAM

The Intergovernmental Planning Program for OCS Oil and Gas Leasing, Transportation, and Related Facilities (IPP) is a formal coordination and planning mechanism within the Minerals Management Service. The IPP coordinates three OCS program elements: the prelease process, the Environmental Studies Program, and OCS oil and gas transportation planning. The IPP's functions are conducted by the Regional Technical Working Group (RTWG) committee, one of three components of the national OCS Advisory Board. Others are the Policy Committee and the Scientific Committee. The RTWG is composed of representatives of the Federal and State governments, the oil and gas industry, special interest groups, and the public at large. The RTWG for each OCS region serves as the leading planning body of the IPP. Current members of the Gulf of Mexico RTWG are listed in table 9.

One major function of the RTWG in the Gulf of Mexico has been to plan a strategy for transporting OCS oil and gas to onshore locations for use and processing. With the States and the Minerals Management Service assuming the lead roles, the Gulf of Mexico RTWG devised a Regional Transportation Management Plan (RTMP). The purpose of the RTMP is to identify land and water areas in the Gulf of Mexico that are suitable for accommodating facilities for transporting OCS oil and gas. The first edition of the Gulf RTMP was made available in June 1981.

The RTMP is designed to balance the planning considerations of the highly developed central and western Gulf against the near-frontier conditions of the eastern Gulf. The plan presents three levels of detail, where each succeeding step is more detailed and tailored in relation to specific OCS actions than the preceding step.

TABLE 9.—Gulf of Mexico Regional Technical Working Group Committee

Member	Affiliation
Mr. John Rankin Acting Minerals Manager (Co-chair)	Minerals Management Service
Dr. E.G. Wermund (Co-chair)	State of Texas
Dr. L.F. Baehr Ad Hoc Member	U.S. Army Corps of Engineers
Capt. John M. Duke	U.S. Coast Guard, 8th District
Mr. Clinton Spotts	Environmental Protection Agency
Asst. Regional Director for Environment	Fish and Wildlife Service
Mr. Don Moore	National Oceanic and Atmospheric Administration
Dr. Ernest Mancini	State of Alabama
Mr. Walter Kolb	State of Florida
Dr. Charles Groat	State of Louisiana
Dr. Richard Leard	State of Mississippi
Mr. John Wolfe, Jr.	American Petroleum Institute
Mr. Charles Bedell	International Association of Drilling Contractors
Mr. Rick Anderson	Interstate Natural Gas Association of America
Mr. J. Duane Orr	Private Consultant
Mr. Walter Fondren, III	Private Sector
Mr. J.E. Thomas	Private Sector
Ms. Doris Falkenheiner	Public Law Utilities Group

NOTE: For additional information, contact Syd Verinder, Regional IPP Coordinator, at (504) 589-6541.

Service activities at Amelia, Louisiana. (Photograph by Doug Slitor, MMS.)

Level I planning focuses on broad, macro planning considerations such as inventories of existing environmental concerns and constraints. Utilization of Level I planning would occur in areas having no leased tracts. Level II planning is used to identify high risk or sensitive areas and is applied to areas having leased tracts but no commercial discoveries. Level III involves the detailed planning of the coastal zone and Federal waters, and it is used to plan for transportation siting (usually pipelines) and related energy facilities in specific zones shoreward from marketable discoveries. This third, and most detailed, level of planning requires the classification of areas into one of three specific management classes: suitable for development, suitable with stipulations, and unsuitable.

Due to the existing leasing and development conditions, the Gulf of Mexico RTMP currently uses only Level II and Level III planning. Florida's jurisdiction, which includes the State waters of the eastern Gulf south to lat 25 deg N. is at Level II planning; the remaining four Gulf States have produced Level III plans for their respective jurisdictions. The Federal OCS has been planned using a Level III analysis. The entire Gulf of Mexico RTMP is an integrated composite plan, consisting of the individual State's plans and the Federal plan with each jurisdiction evalu-

ated (planned) at the detail appropriate to the area. As changes in the region occur due to policy and administration or offshore developments, the RTMP may be revised based on a reevaluation using the three-level planning method.

The Gulf of Mexico RTMP is tailored to the region's needs, and it addresses the already high level of offshore oil and gas operations and the decisionmaking process to transport hydrocarbon resources to shore. The central and western Gulf have the most complex and fully developed infrastructure for oil and gas production in the world. The facilities include refineries and petro-chemical processing plants, offshore service and supply bases, construction yards for pipelines, platforms, equipment, and boats, and other industry-related installations. The core of this development is located in the central Gulf, with activity stretching into the western Gulf. The infrastructure in the eastern Gulf remains largely undeveloped east of Pascagoula, Mississippi.

Because the occurrence of OCS oil and gas to date has been concentrated in the central and western Gulf, the infrastructure for processing has largely developed in the nearest adjacent coastal zone, namely Louisiana and Texas. The capital-intensive nature of the oil- and gas-processing industry does not lend itself to industrial flexibility regarding relocation options at this stage, nearly 50 years after the region's first offshore production. The Gulf RTMP attempts to implement a planning process that allows the introduction of additional transportation facilities into a relatively fixed infrastructure while recognizing the mandate to avoid unacceptable environmental consequences. The RTMP also allows for early and comprehensive planning for frontier sections of the Gulf, such as Florida, by using the three-level approach.

GULF OF MEXICO REGIONAL TECHNICAL WORKING GROUP: SUMMARY OF RECENT ACTIVITIES

The Gulf of Mexico Regional Technical Working Group met three times during 1981. The meetings covered pre-lease sale activities, deliberations on the regional environmental studies plan for fiscal year (FY) 1983, and the status of the Department of the Interior's proposed leasing program, streamlining efforts, and the forthcoming regional environmental impact statement.

On April 7, 1981, the RTWG met in New Orleans, Louisiana. The initial session consisted of briefings on environmental matters, nominations of blocks, and tentative tract selection for upcoming Lease Sales 72 and 74. Bureau of Land Management officials presented a briefing on the regional EIS concept and solicited comments from RTWG members on its preparation. Further discussions focused on BLM's Regional and National Studies Plans and the then soon-to-be-issued Regional Transportation Management Plan.

Again on April 27-28, 1981, the Gulf of Mexico RTWG met in joint session with the South Atlantic RTWG. The purpose was to discuss the current status of the BLM studies program and to identify studies to be funded under the program in FY 1983. The end product of the 2-day workshop was the New Orleans OCS Office draft Regional Studies Plan for FY 1983. The draft plan includes proposed studies and point rankings as determined by the RTWG. Copies of the plan may be inspected at the Minerals Management Service OCS Office in New Orleans. A similar plan for FY 1984 will be available for public inspection at the same location anytime after June 15, 1982.

The RTWG held a 2-day meeting in New Orleans, Louisiana, on November 19-20, 1981, to discuss the status of DOI's proposed leasing schedule and streamlining procedures. Further discussion focused on the multi-sale regional environmental impact statement now being prepared by the Minerals Management Service. RTWG members were briefed in detail concerning the scoping efforts for the Gulf regional EIS. BLM staff gave presentations on coastal habitats; commercial fisheries; marine sancturies; endangered species and wildlife resources; recreation resources; tourism; air quality; employment, income, and marine transportation; land use and planning conflicts; community services and facilities; water quality and supply; archeology; military use zones and operational constraints; biologically sensitive areas; and pipeline transportation. The draft regional environmental impact statement was published in August 1982.

4. Nature and Location of Nearshore and Onshore Facilities

Over the last four decades, an immense industrial complex has developed in the Gulf of Mexico coastal zone. The number, size, and variety of service, supply, and processing facilities, especially those associated with the offshore industry, have defied all reasonable attempts at establishing a comprehensive regional inventory. If such an industrial inventory were feasible, or even useful, it would quickly be out of date because the region is not static. Many of the region's installations are capital-intensive, thereby possessing considerable locational inertia; others are utterly without locational permanence, responding to the dynamic rhythms of the offshore industry.

For most of its history, the offshore oil and gas industry and its support functions have operated in the Gulf of Mexico without an extensive regulatory framework like that existing today. Planning considerations for facilities construction in the coastal zone were minimal. Land use conflicts were few, long-term consequences were not recognized, and comprehensive planning was largely unknown.

In recent years, there has been an increased emphasis on Outer Continental Shelf (OCS) oil and gas development, an emerging coastal and environmental awareness, and a more restrictive regulatory atmosphere. Concurrent with these conditions has been a focusing of national attention to coastal and related issues. Specific regulation, much of it passed during the decade of the 1970's, has required regulatory compliance of various types for energy facilities siting. Much of the legislation is Federal, and specific compliance measures may mean preparation of NEPA documents, filing of environmental reports, requesting permits, or broad compliance by the Federal and State governments to ensure that consistency has been achieved between programs. So important is the legislative mandate that operations in the coastal zones of the respective States are planned in a de facto manner without the existence of specific "planning" legislation.

Although the legislation and rulemaking that have influenced recent coastal zone operations has largely been a Federal phenomenon, the States have shared in the decisionmaking. Examples include the national OCS Advisory Board and its Intergovernmental Planning Program for OCS transportation facilities, the consistency provisions of the Coastal Zone Management Act, and the opportunities for State participation in the Department of the Interior's offshore leasing program.

With this legislation and the opportunities for State participation in place, planning for major energy-related facilities siting in the coastal areas has taken on a greater importance than at earlier times. Energy-related facilities planning in nearshore and onshore areas continues to be a prerogative of the individual States and local jurisdictions. This edition of the summary report, like the earlier editions, is structured to assist environmental, physical, social, and other planners with their information needs concerning OCS oil and gas activities as they bear on coastal jurisdictions.

The remaining portion of this chapter presents a brief summary of major facilities in the Gulf Coast.

ONSHORE SUPPORT FACILITIES

OCS facilities construction remained stable over the past year. Oil production from the Gulf OCS remained stable and gas produc-

tion increased slightly. The worldwide oil industry experienced a glut. The market conditions during 1981 for most of the Gulf Coast fabricators were unfavorable, even dismal. Forecasts do not indicate improvement for several years (Ocean Construction Report, 1982d).

Currently, slack demand for oil, platforms, and pipelines exists in the United States. In part, this has caused refinery closings and some operations to be curtailed. Marginal refineries and those unable to accommodate high sulfur ("sour") crude oil have become the casualties of the depressed market conditions. Conversions at other refineries have boosted some capacities.

New or Proposed Service and Supply Facilities

Additions to the offshore service and supply infrastructure are planned or are under way in both the western and eastern Gulf. Two offshore support bases are nearing completion along the Texas coast. In Aransas County, Texas, north of Corpus Christi, a major facility is being constructed on an 85-acre (34-hectare) site known as the Offshore Support Center. A complex of offices, storage facilities, a covered warehouse, docking space, and areas for helicopters, fuel, and water will be located at the site. The site is served by a recently constructed rail spur.

Another offshore service center is located on a 63-acre (25-hectare) tract just south of the site described above. It includes a 7-acre (2.8-hectare) harbor with docking facilities capable of handling workboats and crewboats up to 200 feet (61 m). The center will also contain fueling facilities, fresh water, continuous crane service, and rail service to facilitate equipment deliveries from manufacturers outside the region. Additional space is to be available for lease to offshore support businesses and drilling contractors. Both offshore service centers will be com-

Typical platform fabrication facilities north of Corpus Christi, Texas. (Photograph by Jeffrey Wiese, Rogers, Golden & Halpern.)

pleted in phases (Ocean Construction Report, 1981a).

Plans for a major service base near Corpus Christi were announced in November 1981 by Baker Marine. Baker Marine, a major mobile rig fabricator, has developed plans for a new energy-related service base to be called Baker's Port on a 3,000-acre (1,214-hectare) site adjacent to the firm's Ingleside, Texas, yard. Sharing 50 percent of the interest is Promet, a Malaysian company. Baker's Port will be developed in four phases. Plans are to attract about 100 different firms to locate at the site, which will include docks for deep-water vessels. The first phase, involving dredging of channels to the Intracoastal Waterway, is scheduled for completion by the end of summer 1983. Part of the acreage is currently occupied by Chicago Bridge and Iron's small platform fabrication yard. Chicago Bridge and Iron is likely to continue its operation there until Phase 4 development of Baker's Port is initiated (Ocean Construction Report, 1981b).

Pleasure Island Development Commission has plans for a major shipyard to be constructed near Port Arthur, Texas. Pleasure Island fronts Lake Sabine and is owned by the city of Port Arthur. Pleasure Island officials plan to have the shipyard site appraised in order to get bids from yards interested in leasing the property for use as a shipyard. It was earlier anticipated that Levingston Shipbuilding would move its Texas Gulfport Shipbuilding yard to the new Port Arthur site upon expiration of its current lease, but Levingston may not make the move now because of market uncertainty (Ocean Construction Report, 1982a).

In another development, Blue Streak Industries of Chalmette, Louisiana, has acquired a shipyard site in the Port Bienville Industrial Park near Bay St. Louis, Mississippi. Blue Streak Industries is a designer and fabricator of offshore vessels. The firm plans to use the 18-acre (7.3-hectare) parcel to build jack-up work barges. The vessels to be fabricated are now in the engineering stage. They will be larger vessels with a broader range of capabilities, increased crew quarters, larger crane capacities (in the 100-ton (91-metric-ton) range), and increased depth operating capabilities (in excess of 100 feet (30 m)). The purpose of the expansion is to effect prompt delivery of current orders and to meet an anticipated increase in demand for this particular type of vessel (Ocean Construction Report, 1981c).

While the western and central Gulf of Mexico oil and gas support infrastructure is quite extensive and complex, the support facilities in the eastern Gulf are still in the early stages of development.

Pensacola and Panama City, Florida, have served as onshore service and supply bases for previous exploratory facilities in the northeastern Gulf. Port Manatee, Florida, another eastern Gulf port, has also experienced a small degree of OCS-related development. As stated in chapter 2, 30 tracts in the Charlotte Harbor administrative area were leased in two recent OCS lease sales, Lease Sale 66 and Lease Sale 67. Exploration of these leases will most likely be supported from Port Manatee, inasmuch as the required support industries--primarily drilling mud and cement suppliers and air and marine transportation--already exist at the port.

In anticipation of these probable future demands, Port Manatee is conducting a study to ascertain the need for and feasibility of expansion at the port. The study is being funded by Coastal Energy Impact Program monies, which is discussed in more detail in appendix B.

Planning Considerations

The siting of offshore service and supply operations has resulted in conflicts with other land uses, especially in Texas, where commercial shrimping activities exist side-by-side with the offshore oil service industry. Frequently, these two groups compete for the available dock space within a region. As the bidding for dock space has intensified, commercial shrimping operations have been unable to compete with the higher prices the offshore

Shrimp vessels at dock. (Photograph by Doug Slitor, MMS.)

oil and gas industry operators have been able to pay for the most desirable and accessible water frontage. The result has been the crowding of numerous shrimpers into even smaller spaces in less desirable locations, more distant from the open Gulf waters. To date, the most critical competition exists in the areas near Galveston and Freeport, Port Isabel and Brownsville, and Port Aransas and Rockport, Texas.

The problem, not yet an open conflict, is likely to intensify in the future. Competition between the two groups is increasing for two reasons: (1) the closure of Gulf waters under Mexican jurisdiction to U.S. commerical shrimpers has driven them back to Gulf waters off Texas, and (2) rising OCS activity off Texas has brought and will bring more offshore operators to the Texas Gulf Coast (Miloy, 1982, oral commun.).

Platform Fabrication Yards

Platform fabrication yards are industrial construction facilities where platforms (decks and jackets) used to drill for and produce offshore oil and gas are built. Almost without exception, mobile rigs and production platforms used in the Gulf of Mexico are of the steel jacket variety, rather than concrete; the obvious exceptions are drillships. One of the largest concentrations of platform fabrication

Platform fabrication yard at Amelia, Louisiana. (Photograph by Douglas Slitor, MMS.)

yards along the Gulf Coast is in the vicinity of Amelia and Morgan City, Louisiana. The accompanying photograph shows numerous platform fabrication yards along a tributary bayou of the Atchafalaya River.

Platform fabrication yards are located, of necessity, on large open waterfront sites. This allows newly fabricated rigs and platforms to be floated to drill sites to commence exploration or for installation preceding development/production drilling. There were 139 platforms installed in the Gulf of Mexico in 1981, and 117 platforms are scheduled for installation in 1982; however, in 1983, new platform installation may decrease in number to 70 or 75 (Pagano, 1982, oral commun.)

Industry representatives anticipate that platform fabrications for the near term will be for water depths in the 150 to 300 foot (45-91 m) range. Platforms for deeper waters will be required again in 1984 and beyond (Ocean Construction Report, 1982d). Table 10 shows the locations and lists the operators of the major platform fabrication yards in the Gulf of Mexico.

NEW OR PROPOSED PLATFORM FABRICATION YARDS. Additions to the existing

TABLE 10.—Existing platform fabrication facilities

Location	Firm
Texas	
Beaumont	Bethlehem Steel
Brownsville	Marathon-LeTourneau
Channelview	Vemar
Houston	Brown and Root
Ingleside	Baker Marine
Ingleside	Chicago Bridge & Iron
Orange	American Bridge (U.S. Steel)
Orange	Levingston Shipbuilding
Port Aransas	Brown and Root
Port Arthur	Levingston Shipbuilding
Louisiana	
Amelia	Raymond Fabricators
Harvey	Avondale Shipyards, Inc.
Harvey	Brown and Root
Harvey	McDermott Incorporated
Harvey	Williams-McWilliams Co., Inc.
Houma	Benoit Machine
Houma	Delta Fabricators
Houma	Houma Welders
Lafayette	Teledyne Movible Offshore, Inc.
Morgan City	Twin Brothers
Morgan City	Avondale Shipyards, Inc.
Morgan City	Brown and Root
Morgan City	Corbitt Allen, Jr.
Morgan City	McDermott, Inc. (Bayou Boeuf)
Morgan City	McDermott, Inc. (Bayou Black)
Morgan City	Service Machine Group
New Iberia	Universal Fabricators
New Iberia	Blue D Fabricators
New Orleans	Avondale Shipyards, Inc.
New Orleans	Williams-McWilliams Co., Inc.
Mississippi	
Gulfport	McDermott, Inc.
Pascagoula	Ingalls Shipbuilding
Pascagoula	Chicago Bridge & Iron
Vicksburg	Marathon-LeTourneau

inventory of platform fabrication yards are not anticipated in the near future. As noted, the industry currently has an excess capacity compared to the market demand. Layoffs within the group have been common. Offshore drilling activity is likely to remain at the present level for the coming year. A decline in the market for equipment could have an adverse effect on producers of shallow water jack-up rigs (Ocean Construction Report, 1982d).

Refineries

The refining industry in the United States is undergoing an unparalled restructuring of its processing capabilities and capacity. The end result is likely to be a modernization of the industry, leaving it one of the healthiest and most advanced in the world. The remarkable feature of this streamlining process is that it will likely occur without the construction of any new grassroots (built from the ground up) refineries. Although the modernization process is national in scope, it has significance within the Gulf of Mexico Region because 40 percent of the U.S. refining capacity is located there. The modernization will add little, if any, net gain to the Gulf Coast's refining capacity. In fact, the region may end up with fewer, but larger, refineries and a slightly diminished overall capacity as efforts to consolidate and update the facilities are accomplished.

Refineries located in the coastal zone of the Gulf of Mexico number 68; this is a net decrease of one refinery over the 69 reported in the previous edition of the summary report. However, seven Gulf Coastal refineries are presently listed as inactive or are otherwise not operating. This leaves 62 refineries in operation in the region as of this writing; many others are operating below capacity. Table 11 shows the refining capacity by State for the Gulf Coast.

Gulf Oil Corporation has closed its refinery at Venice, Louisiana. The plant has been sold and dismantled, permanently removing it from operation. Other deactivited refineries include Manatee Energy Co., Palmetto, Florida; Shepherd Oil, Inc., Mermentau, Louisiana; Bruin Refining Inc., St. James, Louisiana; Vedette Oil Refining, Brownsville, Texas; Adobe Refining Company, La Blanc, Texas; and Dow Chemical Co., Brazosport, Texas. Together these plants have a refining capacity of 301,400 barrels (47,892 m3) per day. It is significant that six of these refineries are small, each having less than 30,000 barrels (4,767 m3) per day of capacity. Only the Dow Chemical Company plant at Brazosport (near Freeport and Lake Jackson), Texas, is a large refinery with 190,000 barrels (30,191 m3) per

Champlain refinery at Corpus Christi, Texas. (Photograph by Jeffrey Wiese, Rogers, Golden & Halpern.)

day of capacity. The deactivation of the small refineries is indicative of the broad trend within the industry to curtail operations at marginal facilities.

NEW OR PROPOSED REFINERY PROJECTS. Against the background of declining demand for refined petroleum products and the changing quality of crude oil feedstocks, anticipated refinery construction projects are limited to conversions of existing plants. These conversions and renovations are designed to accommodate a wider range of crude stocks, including sour crudes. Conversions and renovation projects are also intended to streamline the industry's refining capability by consolidating operations for greater economic efficiency. As stated in the previous edition of the summary report, no grassroots refineries are currently planned for the Gulf Coast region.

Additional Post-Production Facilities

Post-production facilities process, refine, or in some other way treat the petroleum resource after it leaves the producing plat-

TABLE 11.—Refining capacity in the Gulf Coast by State

State	Number of refineries	Crude oil capacity (bpcd)
Alabama	3	96,400
Florida	2	41,400
Louisiana	25	2,408,758
Mississippi	1	280,000
Texas	37	4,496,556

bpcd=barrels per calendar day.

SOURCE: Oil & Gas Journal, 1982c.

form or wellhead. These facilities, usually large and capital-intensive, consist of partial processing plants, refineries, gas treatment plants, and petrochemical complexes.

These types of facilities have experienced a similar decline in market demand in the past year that characterized the platform fabricators and other oil service vendors. Hardest hit have been the refineries. Refiners have had to adjust to an unexpected change in market conditions brought about by the oil glut. They have responded largely by closing or curtailing operations at small or marginally profitable plants. Many Gulf Coast refineries were not designed to process a wide range of crude oil quality. With the current mix of domestic and foreign supplies of crude oil, refineries have had to be converted to accept feedstocks of lower quality and frequently higher sulfur content. The net effect of these dislocations in supply and market conditions has meant that refiners have phased out their small, inefficient refineries while concentrating on renovations at larger, newer, and more profitable plants.

Conclusion

Offshore oil- and gas-related activity in the Gulf of Mexico has slowed since the previous edition of the summary report was published. The recession, combined with plentiful supplies and relatively low prices for oil, have discouraged investment in exploration. The relatively high cost of drilling operations, when viewed against the current market, has generally tightened economic conditions within the industry.

Anticipating that the boom that began with deregulation of oil prices would continue, many operators planned for facilities expansion and investment in equipment. Changing market conditions have caused some of these plans to be temporarily delayed. A few projects in progress have been slowed, especially those where huge capital investments require completion in phases.

With the arrival of improved market conditions in the near future, offshore operations will require a more active pace of exploration. The offshore service industry will respond by building necessary rigs, platform jackets, and drilling equipment and by providing oil- and gas-related services.

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Offshore Construction Report, 1982, v. 8, no. 8, February, p. 1.

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Schuenke, David A., 1982, Chief, Branch of Offshore Rules and Procedures, oral communication, July 13.

Shalowitz, Aaron, L., 1962, Shore and sea boundaries, volume 1--Boundary problems associated with the submerged lands cases and the Submerged Lands Act: prepared for the Department of Commerce, Coast and Geodetic Survey, 276 p. and appendixes.

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U.S. Department of State, 1981, Limits in the sea (no. 36)--National claims to maritime jurisdictions: prepared for the Office of the Geographer, 177 p.

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Appendix A. OCS-Related Studies

FEDERAL STUDIES

U.S. Department of the Interior:

Minerals Management Service

The Minerals Management Service (MMS) of the U.S. Department of the Interior (DOI) conducts an Environmental Studies Program, formerly conducted by the Bureau of Land Management. The MMS Gulf of Mexico OCS Office administers studies approved by the MMS Washington Office for the Gulf of Mexico Region. A number of studies have already been completed for the Gulf of Mexico, and additional studies are planned for fiscal year 1983. Some of the studies were conducted by other agencies within the Department of the Interior as a part of the MMS's Environmental Studies Program. The studies listed below either were not included in previous Gulf of Mexico Summary Reports or their status has changed. Completed studies may be reviewed at the Gulf of Mexico OCS Office of the Minerals Management Service, 3301 Causeway Boulevard, Metairie, Louisiana, or at the Washington OCS Office of the Minerals Management Service, 18th and C Streets, NW., Washington, D.C.

A compilation of information pertaining to all contractual agreements for environmental studies entered into formerly by the Bureau of Land Management and now the Minerals Management Service has been prepared for the OCS Policy Committee by the MMS's Offshore Environmental Assessment Division. The listing includes studies from 1973 to July 30, 1982. Further information regarding the list and its distribution can be obtained by contacting the Branch of Offshore Studies in the Washington OCS Office of the Minerals Management Service.

Barry A. Vittor & Associates, Inc., Gulf of Mexico OCS area polychaete study: Mobile, Ala. Final report due March 1983.

The purpose of this study is to standardize taxonomic identifications of polychaete annelids collected during MMS baseline studies and other studies in the Gulf of Mexico. The specific objectives are quality control-type review of all polychaete collections from those studies, preparation of dichotomous keys to the polychaetes of the Gulf, and preparation of illustrated descriptions of all species.

Continental Shelf Associates, Inc., Gulf of Mexico OCS area study of effects of OCS oil and gas activities on reef fish populations: Tequesta, Fla. Final report due April 1983.

The overall goal of this study is to quantify the effects of marine oil and gas activities on reef fish in the northwestern Gulf of Mexico. Specific study objectives include (1) comparisons of the standing stocks of selected reef fish among various types of habitats ranging from natural reefs to oilfield structures and (2) development of sampling techniques and methodologies that are equally applicable to deeper waters of the Continental Shelf.

Darnell, Rezneat M., Gulf of Mexico ecological mapping project: College Station, Tex.

This study consists of identification, acquisition, and analysis of existing data on benthic fishes and invertebrates of the Gulf of Mexico to develop reliable information on the distribution of selected species, groups of species, and delineation of biologically sensitive areas. Products will include computerized data bases, maps, and text.

Energy Resources Company, Inc., 1982, Ixtoc oil spill damage assessment study: Cambridge, Mass.

This 2-year study began in October 1980, and it monitored changes in hydrocarbon concentrations and population dynamics due to the 1979 Mexican oil spill. Samples taken when Ixtoc oil first impacted the Texas coast were examined as well as post-spill samples. Data was then compared to existing pre-spill studies.

Fish and Wildlife Service, Gulf of Mexico and South Atlantic OCS study on the distribution and abundance of endangered and vulnerable mammals, birds, and turtles. Final report due September 1982.

This study extended over several years, and aerial survey methods were used to survey four initial sites: (1) Brownsville, Texas, (2) Marsh Island, Louisiana, (3) Naples, Florida, and (4) Merritt Island, Florida. The study has six objectives: (1) to determine and confirm which species of marine mammals, birds, and turtles inhabit or migrate through the OCS areas of the South Atlantic and the Gulf of Mexico, (2) to determine their distribution and patterns of movement, (3) to determine and describe any areas of special biological significance, (4) to provide a basis for estimating relative abundance of individual species in the study area, (5) to amplify understanding of population structure and basic ecology of lesser-known species, and (6) to formulate specific questions and investigative methods for subsequent research relevant to effects of oil and gas development and other research priorities.

Fish and Wildlife Service, Northeastern Gulf of Mexico coastal characterization study: Prepared with Nanex, Inc., the State of Alabama, and the Florida Department of Environmental Regulation. Maps anticipated December 1982.

This study is designed to compile and analyze existing information and data identifying functional relationships of natural processes and components of regional ecosystems. Tasks initiated include (1) an environmental literature search and preparation of synthesis papers, (2) mapping of biological resources, (3) preparation of socioeconomic synthesis papers, and (4) preparation of habitat maps.

Fish and Wildlife Service, Southwest Florida Shelf coastal ecological characterization study: prepared with the Florida Department of Environmental Research and Nanex, Inc. Interim reports anticipated April and October 1982.

The study area is the coastal region from Tarpon Springs, Florida, south and east to the Dade-Monroe county line, including all of the Florida Keys. The report will include a compilation of socioeconomic data and synthesis papers, habitat mapping, seagrass and coral reef photography, a coastal endangered species summary, and coastal community profiles of mangroves and seagrasses.

National Aeronautics and Space Administration, 1981, Gulf of Mexico Satellite oceanography study: Wallops Flight Center, Va.

The radar altimeter aboard both GEOS-3 and Seasat provided direct measurement of the sea surface for this study. Previously, the dynamic topography could only be inferred from hydrographic data. Parameters determined included ocean surface wind speed, significant wave height, significant slope, and phase speed. Due to the lack of a good geoid of the accuracy and resolution of the one available for the South Atlantic, the data are of limited value, and no

useful circulation information can be extracted.

National Marine Fisheries Service (NMFS), Recreational fishing at offshore platforms study. Status of final report available from MMS offices.

By interagency agreement with the National Marine Fisheries Service, this study will provide estimates on the total number of Gulf of Mexico fishermen attracted to fishing near oil and gas platforms and their catches. Other study objectives include (1) development of a national policy recognizing the artificial reef benefits of oil and gas structures (active and obsolete), (2) promotion of the preparation of an artificial reef plan for the Gulf of Mexico, (3) establishment of a standard procedure to ensure and facilitate timely conversion of obsolete structures to artificial reefs, (4) identification of legal restrictions that may prevent use of obsolete oil and gas structures as artificial reefs, and (5) identification of research and studies necessary to optimize use of obsolete oil and gas structures as reefs.

New England Coastal Engineers, Southwest Florida shelf circulation modeling study: Bangor, Maine. Final report due October 1982.

Under this project, the Southwest Florida Shelf circulation will be modeled between the Straits of Florida and lat 28 deg N. and from the nearshore to the 328-foot (100-m) isobath.

Restrepo & Associates, 1982, Economic impacts of oil spills on the Texas coasts: El Paso, Tex.

This study will make use of an economic input/output (I/O) model to determine the impacts to tourism, recreation, and commercial fishing along the Texas coast because of major oil spills that occurred in the last several years.

Texas A & M University, Northern Gulf of Mexico topographic features study: College Station, Tex. Final report due September 1982.

This study consists of ongoing monitoring of the East and West Flower Gardens to include geological sampling, current monitoring, submersible observations and sampling, and epifauna plotless line transects and time-lapse photographic study.

Woodward-Clyde Consultants, Southwest Florida ecosystem study: Orange, Calif. Final report due August 1982.

There are three major objectives of this study: (1) to determine the potential impacts of OCS oil and gas offshore activities on live bottom habitats and communities that are integral components of the shelf ecosystem, (2) to produce habitat maps that show the location and distribution of various bottom substrates, and (3) to broadly classify the biological zonation across and along the bottom shelf, projecting the percent of the area covered by live/reef bottom.

Fish and Wildlife Service

Shew, Dale M., Baumann, Robert H., Fritts, Thomas H., Dunn, Linda S., and others, 1981, Texas barrier islands region ecological characterization: environmental synthesis papers: cosponsored by the Bureau of Land Management, FWS/OBS-81/32. Limited distribution through the Information Transfer Specialist, Fish and Wildlife Service, National Coastal Ecosystems Team, NASA/Slidell Computer Complex, 1010 Gause Boulevard, Slidell, LA 70458.

This report is a synthesis of selected environmental literature for the Texas Barrier Islands Region and is part of the Texas Barrier Islands Ecological Characterization Study. These papers deal with six drainage basins along the

Texas coast: Galveston, Matagorda-Brazos, San Antonio, Copano-Aransas, Corpus Christi, and Laguna Madre, as well as the marine system offshore. Topics include the geology, climate, hydrology and hydrography, and the biology of each basin. This synthesis is intended to serve as a general reference work and guide to the literature and to assist in planning for the requirements of OCS oil and gas development and coastal zone management.

Other components of the ecological characterization study include an annotated environmental bibliographic database, socioeconomic synthesis papers, habitat maps, an ecological atlas showing biological resources, socioeconomic features, and oil and gas infrastructure, ecosystem models, and a narrative report.

OTHER STUDIES

Joint Studies

RPC, Inc., 1980, Texas ports study, volumes 2 and 3: sponsored by the U.S. Maritime Administration, the General Land Office of Texas, and the Texas Coastal & Marine Council.

This study was an opportunity for the sponsoring agencies to combine resources to accomplish three goals: (1) the development of information necessary to ensure the continued success of Texas waterborne commerce, (2) the enhancement of multiple use and sound management of Texas coastal resources, and (3) the exchange of information and experience among the diverse groups that manage, develop, and affect marine commerce in Texas. Specific objectives were (1) an update and validation of the U.S. Maritime Administration's Port Facilities Inventory of Texas, (2) a description of current and future estimates of commodity flows through Texas ports, (3) an analysis of the demand for and capacity of Texas ports, (4) a description of organizational and financial matters affecting Texas ports, (5) an assessment of the economic impact of the Texas port industry, (6) a test of the U.S. Maritime Administration's national port economic input/output model for application in Texas, and (7) a refinement and test of a methodology for assessing port development and waterway activities. Volume 1 contains the main report, conclusions, and an annotated bibliography. Volume 2 contains projections of commodity flows through Texas ports and discussions of technological trends, and environmental policy issues, inland transportation policies, and organizational and financial matters affecting Texas ports. Volume 3 contains an analysis of current waterborne commodity flows on the Texas Gulf Coast. Volume 4 contains a description of the capabilities and economic impact of Texas ports and an assessment methodology for port development and waterway activities. Volumes 1 and 4 have not been published as of this writing.

Mississippi-Alabama Sea Grant Consortium

Nissan, Edward, and Williams, D.C., Jr., 1980, The economic structure of Mississippi's coastal region: Ocean Spring, Miss., Mississippi-Alabama Sea Grant Program 78-052. Limited distribution through the Mississippi-Alabama Sea Grant Consortium, Caylor Building, Gulf Coast Research Laboratory, Ocean Springs, MS 39564.

This paper prepared for the Seventh Annual Conference of the Midsouth Academy of Economists concerns the construction of an input-output model for the coastal region of Mississippi, which includes the counties of Hancock, Harrison, and Jackson. Input-output methodology has become increasingly useful in regional economic analyses where measurements of changes in acti-

vities, such as employment, resulting from an increase in other activities, such as construction of new facilities, are desired.

Nissan, Edward, Williams, D.C., Jr., and Brister, Bill M., 1981, Economic-ecological model for Mississippi-Alabama coastal counties: Ocean Springs, Miss., Mississippi-Alabama Sea Grant Program 79-029. Limited distribution through the Mississippi-Alabama Sea Grant Consortium, Caylor Building, Gulf Coast Research Laboratory, Ocean Springs, MS 39564.

This report is an adaptation of an empirical model "materials balance approach" developed in an effort to objectively evaluate economic-ecologic tradeoffs in a given area, in this case the coastal counties of Mississippi and Alabama. The model uses the Leontief input-output methodology, which consists of three phases: (1) development of an input-output accounting of the region, measured by the flow of goods and services in dollar amounts for a given period of time, (2) development of an inventory of water and air pollutants, as well as solid wastes, that were produced as consequences of economic activities of the diverse producing sectors, including households, and (3) incorporation of this data into a matrix-based economic formula.

Simon, George, Garber, Elizabeth, and Farnell, Sarah Kathryn, 1981, State and Federal claims to submerged lands in the Mississippi Sound: University, Ala., University of Alabama Law Center's Office of Energy and Environmental Law Monograph 1 Revised and Mississippi-Alabama Sea Grant Program 81-010(2). Limited distribution through the Mississippi-Alabama Sea Grant Consortium, Caylor Building, Gulf Coast Research Laboratory, Ocean Springs, MS 39564.

This monograph provides a historical and legal overview of conflicting Federal and State claims to certain of the submerged lands in the Mississippi Sound affected by OCS Lease Sale 62. A discussion of the Outer Continental Shelf Lands Act, the Submerged Lands Act, and common law applicable to the claims is presented.

University of Alabama Law Center, Office of Energy and Environmental Law, 1980, Alabama energy and environmental agencies: University, Ala., University of Alabama Law Center's Office of Energy and Environmental Law Monograph 2 and Mississippi-Alabama Sea Grant Program 79-008-2. Limited distribution through the Mississippi-Alabama Sea Grant Consortium, Caylor Building, Gulf Coast Research Laboratory, Ocean Springs, MS 39564.

This monograph is a compilation of information on the structure and function of Alabama's energy and environmental agencies. Each agency entry includes reference to its statutory authority, a description of the agency's responsibilities and specific statutory mandates, a discussion of the agency's fulfillment of those responsibilities and its coordination activities with other agencies and organizations, and a brief summary listing of the statutes, regulations, secondary material, coordinate agencies, and subject areas under the agency's jurisdiction.

University of Texas at Austin

Manners, Ian R., 1980, The Coastal Energy Impact Program in Texas: Austin, Tex.

This study outlines the role and use of Federal funds for energy impact assessment and mitigation along the Texas Gulf Coast. Research was directed toward an evaluation of planning strategies developed and implemented by States involved in offshore production. Specific objectives were to ascertain (1) the extent to which planning strategies, evolving from Federal pressures and local initiatives, enhanced impact

assessment and mitigation procedures in the coastal zone, (2) the manner in which local communities used funds available under the Federal impact assistance program, and (3) the effectiveness of such initiatives in diminishing community apprehensions over the social and environmental costs of offshore oil development.

Wiese, Bonnie R., and White, William A., 1980, Padre Island National Seashore: a guide to the geology, natural environments, and history of a Texas barrier island: Austin, Tex., the University of Texas at Austin's Bureau of Economic Geology Guidebook 17. Available at cost from the Bureau of Economic Geology, University Station, Box X, Austin, TX 78712.

This non-technical guide to the Padre Island National Seashore was prepared to provide an introduction to the natural environments and active processes that compose this South Texas barrier island, which extends southward from Corpus Christi, Texas, almost to Mexico. The guide includes a description of the phyical environment, the geologic history of the island, a discussion of the dynamic environmental processes impacted by nature and man, a description of the barrier and lagoon systems, and a history of human activity on the island.

Appendix B. Onshore Coastal Issues in the Gulf of Mexico

Appendix B contains a brief review of a series of onshore coastal issues related to the Outer Continental Shelf (OCS) that have elicited concern among planners who were interviewed in preparation of this report.

The appendix opens with a tabular characterization of Gulf Coast States and then proceeds with a review of the coastal zone management program. This review of the coastal zone management program contains a discussion of both the Federal consistency provision and coastal energy impact program. The coastal relevant issue discussion is closed out by summary discussions of the following: proposals for Federal sharing of OCS revenues of interest to most interviewed planners; the Texas issue of coastal annexation; wetlands and OCS activites; dredge and fill permitting; barrier islands; and regional planning in the Gulf of Mexico coastal areas.

Most of the issues and activities discussed in appendix B are very closely tied together. The interrelationship of these issues and activities in the Gulf of Mexico, as elsewhere, center on the economic and environmental burdens and benefits of the development of offshore oil and resultant coastal impacts.

Many of the issues and activities reviewed in appendixes B and C are provided for informational purposes only. The planning considerations for different coastal areas will vary according to the relative importance of each issue.

COASTAL COUNTY CHARACTERIZATION

For the purpose of this characterization, only counties that are significantly affected by Gulf waters will be considered "coastal." This definition of coastal may not match that of each Gulf Coast State. Population and business statistics are based on figures from the 1976 census.

"Currently, 27 percent of our population, and 28 percent of our businesses are in coastal counties." This quote, and the preponderance of statistical data contained in the coastal county characterization presented in table 12 are extracted from The Coastal Almanac (Ringold and Clark, 1980).

COASTAL ZONE MANAGEMENT REVIEW

The coastal zone is the scene of one of the most intense focuses of competing uses found on the earth. In this zone, the interdependent activities of land and sea intertwine. Marine transportation, resource development, recreation, and housing are among the strongest and most established competing industries to be found in the coastal zone. In coastal areas, the competition is keen and land prices are at a premium.

As previously pointed out, the definitions of "coastal zone" are numerous. A more

TABLE 12.—Gulf Coast County characterization

State	Number of coastal counties (total counties)	Coastal county's population, 1976	Population change (statewide) a) 1970-1976 b) 1960-1970	Percent of business in coastal areas	Percent of employees in coastal areas	CZM approval date
Florida	34 (67)	6,577,400	a) 22.4 (23.0) b) 42.5 (37.1)	58	56	September 1981
Alabama	2 (67)	413,900	a) 9.9 (6.7) b) 3.7 (1.8)	12	12	September 1979
Mississippi	3 (84)	275,500	a) 14.8 (6.7) b) 26.9 (1.8)	11	14	September 1980
Louisiana	15 (64)	1,660,200	a) 7.3 (6.4) b) 15.8 (15.8)	44	49	September 1980
Texas	16 (254)	3,254,300	a) 15.0 (12.5) b) 25.2 (16.9)	26	32	*

*State of Texas withdrew its application for Federal approval (4/30/81).

SOURCE: Ringold and Clark, 1980.

restrictive definition, such as that employed above for coastal characterizations, would hold that approximately 27 percent of the U.S. population lives in coastal counties whose land area is the equivalent of 6 percent of the United States (Ringold and Clark, 1980). Another less restrictive and often quoted estimate is that approximately 50 percent of the U.S. population lives within 50 miles (80 km) of the Nation's coastlines, including the Great Lakes. As of the 1970 census, 42 percent of the American population lived in a county deemed to be coastal by the State coastal zone management programs (Department of Commerce, 1978).

The competing demands for coastal space grew to the point that Congress enacted the Coastal Zone Management Act (CZMA) in 1972 (16 U.S.C. 1451 et seq.). The objectives of the Act are "to preserve, protect, develop, and enhance and restore, where possible, coastal resources. The mechanism to achieve these objectives is through 'encouragement' and 'assistance' to the States. Cooperation of the Federal agencies with the States is pledged to achieve the objectives of the Act" (Department of Commerce, 1978).

The "assistance" to coastal States has been provided in the form of grants and loans. These monies were to allow a coastal State to develop, implement, and administer coastal zone management programs, based largely on their own police powers. In addition to financial support, the CZMA offers the guarantee of "consistency" of Federal actions, which affect a State's coastal zone, with that State's coastal program. The relevance of the consistency clause of the CZMA is discussed next.

Consistency

Section 307 of the Coastal Zone Management Act, P.L. 92-583, was established as an inducement for coastal States to participate in the voluntary Federal coastal zone management program.

As enacted in 1972, section 307 provided that the following activities must be consistent with State CZM programs that have received Federal approval: (1) Federal activities "directly affecting" the coastal zone; (2) Federal development projects in the coastal zone; and (3) private activities affecting coastal zone uses and requiring Federal licenses or permits (section 307 (c)). Section 307 (d) contains a similar provision for State and local government activities receiving Federal assistance.

The CZMA was amended in 1976 to provide, among other things, that OCS lessees submit a consistency certification on exploration, development, and production activities described in OCS plans for State review and concurrence. If the State concurs with all the activities in the plan, the lessee would not thereafter have to submit separate consistency certifications for each activity that requires a Federal permit.

The OCS participation grants available under section 308 (c) of the CZMA, established by the 1978 OCS Lands Act Amendments (P.L. 95-372), provided funding to coastal States with federally approved CZM programs, which allowed them to participate in the OCS program.

A major question has emerged in the evolution of the consistency provisions of the CZMA regarding the extent to which OCS leasing "directly affects" the coastal zone. The issue is important because only Federal activities that "directly affect" the coastal zone must be "consistent to the maximum extent practicable" with approved State CZM programs. The 1976 amendments to the CZMA clearly include post-lease activities as a category subject to consistency review by coastal States, but the question of whether the pre-lease activities of the Department of the Interior are subject to consistency determinations was not clarified.

After the Department of Commerce made several attempts to resolve this question through rulemaking, it is now being addressed by the courts. In 1981, a District Court in California ruled that the Department of the Interior must prepare a consistency determination for Lease Sale 53 (**State of California et al., v. James G Watt et al.,** DC# CV 81-2080 MRP; C.D. Cal., August 18, 1981). This initial ruling held that the lease sale "directly affected" California's coastal zone. This decision was appealed by the Department of Justice.

On August 12, 1982, the United States Court of Appeals of the Ninth Circuit filed its ruling on this appeal (No. 81-5799; DC# CV 81-2080-MRP). In upholding the lower court's earlier decision, the Court of Appeals ruled that the Department of the Interior violated section 307 (c)(1) of the CZMA by not providing a consistency determination for Lease Sale 53. While the Court of Appeals found that Lease Sale 53 did "directly affect" the California coastal zone, it opened the question of the meaning of the phrase "consistent to the maximum extent practicable." At this point it is not clear whether the Ninth Circuit's ruling will be appealed to the Supreme Court.

While establishing that the CZMA required a consistency determination for Lease Sale 53, the Court of Appeals ruling did make clear the a coastal State does not possess veto power over DOI lease sale activities. If a State objects to a DOI determination, the issue may be mediated by the Secretary of Commerce, as provided by section 307 (h) of the Coastal Zone Management Act.

Once it is clear that the judicial process has been completed, the Department of Commerce, which is responsible for implementing the CZMA, is expected to undertake rulemaking regarding section 307 (c)(1). The Department of Commerce is now consulting with State coastal program managers, Federal agencies, congressional staffs, and other interested parties in preparation for this rulemaking.

Together with section 307, an additional inducement offered coastal States to develop a coastal zone managment program was provided in the form of Federal financial assistance to help these States meet or avoid negative coastal impacts from energy development.

The Coastal Energy Impact Program

Though all portions of the CZMA have relevance to offshore oil production and any resultant onshore impacts, section 308 is most directly tied. Section 308, otherwise known as the Coastal Energy Impact Program (CEIP), was established by amendment of the CZMA in 1976. This section was enacted by Congress after long debates on how best to help coastal States meet the impacts of accelerated offshore oil and gas exploration and development/production. An additional objective of CEIP was to assist States in meeting the

demands of increased energy facility siting in the coastal zone.

The increase in energy-related activity in, or affecting, the coastal zone was projected from the goals of Project Independence, a Presidential directive to lessen U.S. dependence on foreign sources of oil (Manners and others, 1980). The CEIP was authorized by Congress for a 10-year period to assist coastal States through this period of adjustment. Because the nature, severity, and timing of these impacts varied by region, the CEIP was designed to offer different forms of assistance. To be eligible for the grants, loans, or bond guarantees available from the CEIP, a coastal State must have been developing or administering its coastal management program under the CZMA, or be developing a similar program consistent with the CZMA. Table 13 presents a list of CEIP offices for each Gulf Coast State from which further information on State-specific programs and projects can be obtained.

The budget-paring precipitated by demands for fiscal austerity did not avoid the coastal zone management program. While there are differences of opinion and approach between the Administration and Congress, it appears that federally subsidized coastal zone management will be phased down. The CZMA was intended by Congress to provide a longer period of State support, but budgetary constraints dictate otherwise (sect. 318, P.L. 96-464).

All coastal States have received development grants and most have utilized implementation and administrative grants. At present, approximately 87 percent of the Nation's coastline is included in State management programs (National Oceanic and Atmospheric Administration, 1981).

TABLE 13.—Gulf Coast region CEIP offices

Texas	Budget & Planning Office Office of the Governor 411 W. 13th Street Austin, Texas 78701 (512) 475-6156
Louisiana	Phil Pittman CEIP Administrator Dept. of Natural Resources P.O. Box 44396 Baton Rouge, Louisiana 70804 (504) 342-7591
Mississippi	Gordon Larsen Bureau of Marine Resources P.O. Box 959 Long Beach, Mississippi 39560 (601) 864-4602
Alabama	David Barley Office of State Planning and Federal Programs 3734 Atlanta Highway Montgomery, Alabama 36131 (205) 832-6400
Florida	Jim Quinn Office of Federal Coastal Programs Dept. of Vet. & Community Affairs 2471 Exec. Center Cir., East Tallahassee, Florida 32301 (904) 488-9210

OCS REVENUE SHARING

In 1972, the U.S. Congress passed, and President Nixon signed into law, P.L. 92-583--the Coastal Zone Management Act. Enacted as a voluntary program, participating coastal States were directed by the CZMA to plan and implement coastal management programs to meet and ameliorate increasing developmental pressures. Coastal pressures have continued to increase in the 9 years since passage of the CZMA. The increase can largely be attributed to demographic shifts to coastal areas, expansion of coastal-dependent industries, and a dramatic increase in exploration and development/production of hydrocarbons from the U.S. Outer Continental Shelf.

The CZMA was reauthorized and amended in 1976 to establish the Coastal Energy Impact Program to assist coastal states and localities in planning for and mitigating the impacts of energy development. The CEIP was proposed by the Ford Administration as an alternative to a number of congressional initiatives designed to implement an OCS revenue-sharing mechanism. The CZMA was also

amended, in 1976, to require that States participating under the CZMA plan for energy facility siting in the coastal zone.

During the reauthorization of the CZMA, in 1980, Congress further amended the Act to provide incentives for coastal States to improve their coastal management programs. An additional amendment expanded eligibility for funding under CEIP to include activities related to coal transportation and storage and ocean thermal energy.

As may be obvious by the preceding synopsis, the CZMA, while providing support for State coastal management planning, has gradually increased State responsibilities. As these responsibilities have grown, so has coastal State dependence on Federal funds provided to meet the objectives of the CZMA. Though the funding for CZMA activities has always been intended to shift from the Federal to State governments, the Reagan Administration's policy of fiscal restraint has dramatically accelerated this transition.

While a policy of fiscal restraint would dictate a decreasing State reliance on Federal funding for CZM activities, the phase-down comes at a time when other Federal funding to States is being curtailed. Further, in an effort to decrease U.S. dependence on foreign energy supplies and, in part, to increase revenues for the Federal Treasury, the Reagan Administration has concurrently proposed a dramatically accelerated program of OCS exploration and development.

To meet their coastal management and OCS review responsibilities, coastal States are searching for alternative funding sources. One such alternative currently being considered by Congress is OCS revenue sharing. In essence, OCS revenue sharing would provide a mechanism through which coastal States would receive a share of Federal revenues from OCS leasing and development.

As of this writing, the 97th Congress is considering four OCS revenue sharing bills. These four bills are the following: (1) H.R. 5543 - introduced into the House of Representatives on February 22, 1982, by Congressmen Jones (N.C.) and D'Amours (N.H.), which currently has 52 congressional cosponsors; (2) S. 2129 - introduced into the Senate on February 23, 1982, by Senator Mitchell (Me.), as a companion bill to H.R. 5543; (3) S. 2792 - which presently has 15 Senate cosponsors - was introduced into the Senate on July 29, 1982, by Senator Stevens (Alaska); and (4) S. 2794 - introduced into the Senate on July 29, 1982, by Senator Weicker (Conn.). To date, hearings have been held only on H.R. 5543 and on S. 2792; these two bills appear to be receiving the most serious attention. The three Senate bills were all referred to the Senate Committee on Commerce, Science, and Transportation, and the House bill was referred to the House Merchant Marine and Fisheries Committee.

These four congressional OCS revenue-sharing bills share several common elements. In general, these bills would provide that a portion of Federal OCS revenues be utilized to fund selected coastal and ocean programs. Each bill specifically addresses the Coastal Zone Management Program, the Sea Grant Program, coastal energy impact activities, and living marine resource programs. These bills vary, however, in their strategy for program funding.

Though particular programs may be funded at the national level, notably the Sea Grant Program, three of the four bills would fund the remaining programs at the State level, utilizing block grants from a fund created from a portion of Federal OCS revenues. The other bill, S. 2794, would fund all programs at the Federal level but would make available to coastal States grants for similar activities.

Activity on OCS revenue sharing has not been limited to the Congress. The President's Cabinet Council on Natural Resources and the Environment has established a working group on OCS revenue sharing, which has met on several occasions to address these current congressional initiatives and the topic of OCS revenue sharing in general.

This heightened congressional and executive branch activity does not guarantee passage and enactment of an OCS revenue-sharing bill. Much of the congressional agenda is still booked with budgetary matters, but the chances for such a bill appear to be increasing.

COASTAL ANNEXATION

An issue of general interest to all Gulf Coast States, but of particular interest to Texas because of its liberal annexation laws, is known as coastal annexation. Port Arthur, Texas, is an unusual case study in how a particular municipality has dealt with the impacts of offshore oil activity. Though this review focuses on Port Arthur because of the notoriety of its case, other coastal home-rule cities in Texas are pursuing similar action. These cities include Crystal Beach, Corpus Christi, and Galveston.

Beginning in 1978, Port Arthur, located inland several miles from the Gulf of Mexico on the Sabine River, began a series of municipal annexations along the Sabine and the Gulf Coast. Then, in 1979, Port Arthur annexed a 1-mile- (1.6-km-) wide strip of the Gulf extending seaward 3 marine leagues (17 km), the limit of State-owned submerged lands. This coastal/submerged lands annexation encompassed an active offshore oil production platform owned by Superior Oil Company. With the annexation complete, Port Arthur placed an ad-valorum property tax on the tract Superior had leased from the State of Texas (Wall Street Journal, 1982).

Subsequent to Port Arthur's coastal/submerged lands annexation, Superior and the State of Texas brought suit to block the action in a State district court. Port Arthur won a summary judgment in this district court and has since won an appeal in the Beaumont Court of Civil Appeals and the Texas Supreme Court (Houston Post, 1982). Superior had based its argument on the assertion that Port Arthur had violated its constitutional rights.

Port Arthur officials have made no pretense concerning their motivations for the annexation. With the impending phase-down of the Federal Coastal Energy Impact Program, described in a previous section of this chapter, Port Arthur claims that the public services to the offshore oil industry, dislocation of the long-established shrimp fleet from scarce dock space, and other socioeconomic impacts from the offshore oil industry require greater fiscal resources than are available to the city without the tax revenues derived from this annexation (Wall Street Journal, 1982).

Much of the offshore activity, however, is taking place in Federal waters where neither the coastal State nor the municipality have powers of taxation. One potential mechanism for assisting affected States and municipalities is through OCS revenue sharing. Several measures are currently before Congress to enact such a mechanism. These bills were discussed in a previous section of this chapter.

As previously mentioned, several other Texas coastal municipalities have annexed submerged lands. To date, the cities of Crystal Beach, Corpus Christi, and Galveston have annexed strips of varying widths into the Gulf of 5 nautical miles (9.3 km), 2 nautical miles (3.7 km), and 3 nautical miles (5.6 km), respectively. The 66th Texas State Legislature passed Senate Bill 1176 to prohibit general law cities from annexing further than 1 nautical mile (1.9 km) into the Gulf. This stricture, however, exempted home-rule cities. House Bill 411 passed the 67th Texas Legislature in May 1981. This bill placed a 2-year moratorium on coastal annexation, preventing coastal home-rule cities in Texas from expanding submerged lands claims in the Gulf of Mexico.

Because of the uncertainties created by coastal annexation for the oil industry as well as local and State government, the 68th session of the Texas Legislature will be addressing this problem in the larger context of coastal issues, which include coastal annexation and the onshore impacts of offshore oil activities.

COASTAL WETLANDS AND OCS ACTIVITIES

Coastal wetlands form a significant part of the Gulf of Mexico's coastal zone and are a valuable natural resource. Due to a set of complex interacting factors that are not well understood, the wetlands of the Gulf Coast, especially those in southern Louisiana, are in jeopardy. Land is disappearing at an unprecedented rate. The factors contributing to this

Louisiana coastal wetlands. (Photograph by Jeffrey Wiese, Rogers, Golden & Halpern.)

loss are both natural and man-induced. These losses of land have been observed and documented in recent studies. While OCS oil and gas activities and their attendant onshore effects have not been singled out as the primary factor in these events, State and local planners need to be aware of the long-term consequences of operating in the coastal wetlands. The dynamic and delicately balanced natural system of the coastal wetlands requires the assessment of planning considerations of all future actions within the wetlands, even the ones that are seemingly inconsequential.

Louisiana has approximately 40 percent of the Nation's coastal wetlands. Coastal wetlands are also found extensively throughout the Gulf Coast Region. Louisiana's wetlands, the most extensive in the region, extend across the southern portion of the State to the Gulf of Mexico. Interstate Highways 10 and 12 generally mark the northern limit of Louisiana's coastal wetlands, which extend from the Sabine River on the west to the Pearl River on the east (shown on **plate 1**).

Louisiana's coastal wetlands have developed as a result of delta formations and channel shifts of the Mississippi River over the past 7,000 years. These fluvial realinements along with sedimentary deposition have created today's wetlands.

The marshes and estuaries of Louisiana's wetlands are among the most productive in the United States. They form the nursery grounds

for shrimp, oysters, crabs, and fish, which in turn are the basis for Louisiana's important commercial fishing industry. Nearly 22 percent of the U.S. commercial fish catch by weight (the largest of any State) came from Louisiana in 1980; the value of the catch was \$178 million (National Marine Fisheries Service, 1981). Additional harvests from Louisiana's coastal estuaries are also represented by fish catches landed in Texas, Mississippi, Alabama and Florida.

Louisiana's wetlands also support a variety of other wildlife having both economic and non-economic value. For example, the area provides a habitat for more than two-thirds of the great Mississippi Flyway's Waterfowl during winter. Millions of other migratory birds depend on Louisiana's wetlands for survival. These birds in turn form the basis for an extensive game-hunting pastime that generates important revenues. The State has an important fur-trapping industry that depends on an extensive and healthy wetlands environment.

The coastal wetlands support Louisiana's sport and recreational fishing industry. Over 500,000 people fish for sport in Louisiana each year. Recreational fishing, including the costs of fishing and boating equipment, transportation, lodging, and other expenses, contributes an estimated \$150 million to Louisiana's economy annually (Louisiana State University Sea Grant College Program, 1981). Loss of any kind to the State's wetlands would have serious economic and environmental consequences.

Land Loss in Louisiana's Coastal Wetlands

Louisiana's coastal wetlands are disappearing at a rate of nearly 50 square miles (129 km2) per year statewide, and the rate is increasing. Since the mid-1950's, an estimated 500,000 acres (202,350 hectares) or 800 square miles (2,071 km2) of marshland between Vermilion Bay and the Mississippi State line have been lost. If this rate were allowed to continue, within 50 years large coastal portions of St. Bernard, Plaquemines, Jefferson, Lafourche, and Terrebonne parishes would be lost. Other coastal parishes would experience similar, but less extensive, land losses. Such land losses, if left unchecked, would exhaust the area's marshland in 65 years.

Land loss in Louisiana must be viewed in perspective. The area is industrialized, and it produces vast quantities of both fish and oil and gas. Approximately 50 percent of the U.S. Army Corps of Engineer's dredging permits are issued for the area. The Mississippi River passes through an intensively industrialized corridor. Wetlands loss rates are generally in proportion to population densities and levels of industrial development. The loss rates, although serious in southern Louisiana, are widespread.

Causes for Land Loss

Land loss results from a combination of natural and man-made causes. Lost land generally consists of marshes or swamps (wetlands) and may occur in three basic ways: (1) wetlands become open water due to natural or artificial processes; loss of this type may be due to erosion, subsidence, or dredging to form canals and harbors; (2) wetlands are covered by fill material and are altered to terrestrial habitat; placement of spoil from dredging is the most common example; and (3) wetlands can be wholly or partly isolated by spoil banks. Some impounded areas are permanently flooded to enhance waterfowl habitat and/or maintain freshwater conditions. Examples of this type of impoundment are on the Sabine and Lacassine National Wildlife Refuges. Some diked areas are drained for agricultural or urban purposes. Most of metropolitan New Orleans, Louisiana, is located on drained wetlands (Craig and others, 1980).

Natural causes of land loss cannot be stopped. These natural causes include sea level rise, lowering of the land surface due to subsidence, and erosion. The terms "sea level rise" and "subsidence" are opposite sides of the same coin and include both effects. Land surface elevations in places are barely above mean high tide. Subsidence or apparent sea level rise of only a few hundredths of a foot

Coastal wetland facilities. (Photograph by Doug Slitor, MMS.)

per year may result in inundation of many square miles of wetlands areas. Inundation of wetlands also increases their vulnerability to wave attack.

Erosion of the barrier islands is also occurring. Barrier islands such as Timbalier and Grand Isle offer natural protection to wetlands from storm surges and hurricanes. Maintenance of these islands is dependent on precise conditions of dynamic equilibrium, but coastal rivers are not delivering an adequate sediment supply to sustain the process. Erosion is also widening the tidal passes between the barrier islands, allowing highly saline sea water to enter the estuaries and coastal marshes. As the passes between the islands widen, their function of controlling the flow and movement of saline water is diminished.

Human activities in the coastal zone have promoted and accelerated land loss. Such actions as depletion of groundwater, and salt, sulfur, and petroleum extraction may have caused the land above to sink due to compaction.

Levee construction to control flooding has accelerated wetland loss. Flood waters transported sediments and nutrients throughout the coastal wetlands marshes, sustaining the growth of wetlands ecosystems. Levee construction has eliminated this important action. Instead, rivers like the Mississippi flow

unimpeded to the Gulf of Mexico. Wetlands are denied nutrients and the cleansing and flushing effects of fresh water. Salt water intrusion is allowed, even enhanced as a result. Furthermore, navigation projects resulting in wide, straight channels provide nearly direct movement of freshwater runoff into the Gulf. These same channels offer little resistance to the high saline water of storm surges and hurricanes from penetrating deep into coastal estuaries and marshlands.

Consequences of Wetlands Loss

The consequences of wetlands loss are of two kinds: environmental/economic and legal/institutional. Environmental consequences include direct habitat loss, saltwater intrusion and eutrophication, loss of a storm buffer, and reduction in the waste treatment capabilities of a healthy marsh, and the decline in nursery grounds important to a vigorous fish and shellfish industry. Most of these environmental consequences translate into obvious and direct economic costs and losses with each incremental loss in wetlands area.

Increasing salinity is a cause as well as a consequence of land loss. Saltwater intrusion deteriorates the marsh. As the hydrology of the system changes, further saltwater intrusion may extend into brackish areas, causing further deterioration and land loss. Left unchecked, the process will continue until the wetlands are completely destroyed.

Channel dredging short-circuits the process of flushing and nourishing the entire wetland, and dilution of wastewater. Instead it shunts urban run-off, water from agriculture, and sewage directly into lakes, bays, and estuaries, where it degrades the water quality and potentially affects the nursery grounds so important to the commerical fisheries.

Coastal wetlands serve as an important hurricane buffer. They absorb the energy from storm surges and provide a water reservoir for storm waters. Areas protected by marsh and barrier islands suffer comparatively little change from severe storms and hurricanes. Degradation of these marshes will likely result in much higher storm damage and recovery costs.

Wetland losses may be directly correlated with fisheries losses. The effect of land loss on commercial fisheries yield is directly related to the areas of coastal wetlands lost. The quantitative and qualitative relationship between intertidal areas and onshore yields of shrimp in Louisiana is excellent. Higher yields are associated with larger areas of wetlands and only incidentally with water surface area (Craig and others, 1980).

The legal implications from wetlands loss in Louisiana are no less profound. The consequences are clear in situations where State ownership and jurisdiction versus the Federal Government's is concerned. When erosion destroys State lands, the State's legal position ultimately is inferior to the Federal Government's paramount rights. This occurs because the baseline, or coastline from which the 3-nautical-mile (5.6-km) territorial sea (the bottom of which belongs to the State) is computed, is measured from the points of land that extend farthest into the Gulf of Mexico, whether they are privately or State owned. When State lands erode, the baseline (and therefore the territorial sea) moves landward.

In a 1969 Supreme Court ruling with **United States v. Louisiana**, two decisions involving the legal implications of coastal erosion in Louisiana were rendered. The Court decided that international law must be applied to determine Louisiana's coastline. That decision had the effect of minimizing Louisiana's offshore claims. Secondly, the court declared Louisiana's coastline to be ambulatory. This allows Louisiana's baseline to be moved landward as the coast erodes. Such an action would result in a substantial loss of offshore oil revenue to the State. A June 1981 decree by the Supreme Court also makes it clear that if Louisiana's coastline recedes due to erosive forces, the United States would have the right to seek a more favorable boundary with the State in court (Hribernick, 1981).

Mitigation Strategies and Prevention Measures

Several solutions have been proposed to mitigate the loss of wetlands and to prevent further deterioration of this valuable resource. Generally, these proposed measures consist of diverting fresh water into the marshes from

canals and rivers to decrease the incidence of saltwater intrusion. Other strategies involve the dispersion of dredge spoil, thereby lessening its adverse effects, and minimizing new development in wetlands areas. These strategies are prudent and they touch upon the essence of managing the problem of wetland loss. But the natural balance must be reestablished.

Minimizing coastal wetland losses may be achieved in two ways: (1) by building additional land to offset the loss of land in other areas, and (2) by reducing, where possible, the impact of natural and man-made factors that are most important in increasing coastal wetland losses (Craig and others, 1980).

Land building may be encouraged by ambitious programs. One method is by diverting the region's major rivers to initate the formation of subdelta lobes, to increase upper deltaic plain aggradation (surface depositional buildup), and to control salinity. Land building may be accomplished by managing and dispersing dredge spoil. If properly dispersed, dredge spoil will promote the development of new marsh.

Mitigating the effects of man-induced land loss may prove to be the more difficult management technique. In order to be effective, man's activities must be pursued without disrupting the wetland hydrology. The following recommendations would prevent or mini-

Coastal wetland facilities. (Photograph by Jeffrey Wiese, Rogers, Golden & Halpern.)

mize the amount and rate of land loss from man's activities in the wetlands (Craig and others, 1980). Most of the recommendations bear on the activities of offshore operators and the oil and gas service industry among others:

- Construct no new canals that connect the edge and center of a hydrological basin;
- Construct no new canals that connect fresh and saltwater areas;
- Plug pipeline canals wherever possible at both ends and at intervals between in order to reduce water flow and eliminate boat traffic and to decrease the annual rate of widening. If a canal crosses a natural creek bank, plugs should be placed where the canal intersects the natural tributary;
- Build no new wetland impoundments;
- Minimize new canal construction through multiple use of existing canals, integrated planning, common use of pipeline canals, and directional drilling. The alinement of canals should take advantage of the existing natural or man-made channels;
- Reserve adequate spoil disposal sites and easements on high, dry land (non-wetland area) for future dredging; or use the spoil to build "new" marsh; and
- Avoid "fingerfill" development in wetlands by restricting residential development and canals to non-wetland areas.

Recent Efforts to Stem Wetlands Loss

Louisiana has taken action to preserve its wetlands. Action has included approval of the Coastal Environment Protection Trust Fund, whose monies are to be allocated to combating Louisiana coastal erosion. In other action, efforts are currently under way to get Federal help to acquire, preserve, and protect a large portion of the Atchafalaya River Basin for multiple use management.

In November 1981, Gov. David C. Treen of Louisiana signed a bill into law that would allocate $35 million from the Coastal Environment Protection Trust Fund to fight coastal erosion. Money from the trust fund is accumulated as a result of the State's mineral development. With this legislation, fighting coastal erosion has been given a higher priority as a State policy. The new funds, while acknowledged to be meager compared to the magnitude of the problem, represent an important step in planning a strategy for coastal impact mitigation.

DREDGE AND FILL PERMITTING

Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers (COE) to issue permits governing the discharge of dredged or fill materials into the navigable waters of the United States, at specific disposal sites (33 USCA 1344 (1978). Section 404 was established under amendments to the Federal Water Pollution Control Act, in 1972. Since this time, COE's Section 404 Program has gone through significant jurisdictional expansion.

In its initial regulation, the Corps equated the jurisdiction of Section 404 to that of section 10 of the Rivers and Harbors Act of 1899. Section 10, though it covers more activities, is applicable only to "navigable waters" as traditionally defined by the courts (42 F.R. 37,122 (1977)). However, in 1975, the District Court for the District of Columbia determined that Congress had intended the interpretation to be more extensive (**N.R.D.C. v. Callaway**, 392 F.Supp. 685 (D.D.C. 1975)). New regulations, issued by the Corps in 1977, reflect the District Court's decision and refer to those areas subject to COE's Section 404 Program as the "waters of the United States" (33 C.F.R. 323 2(a)(1) (1979)).

Section 404 permitting became a tool of the environmental movement in its bid to stem the annual loss of wetlands to development activities. Through a series of Memoranda of Understanding, COE's Section 404 permitting process includes consultation with the Environmental Protection Agency, the Fish and Wildlife Service, and the National Marine Fisheries Service. Congress mandated this consultation to ensure that wildlife, recreation, and municipal water supplies were considered equally in the Section 404 permit decision.

Expansion of the jurisdictional coverage and consultative process of COE's Section 404 dredge and fill program has brought with it charges of economic burden by development interests. These charges stem from perceived delays in permit issuance or denial, and from project modifications imposed on a developer as a condition for permit issuance by one or more agencies in the Section 404 consultative process.

In response to these charges, the President's Task Force on Regulatory Relief undertook a thorough review of COE's Section 404 Program, initiated in August 1981. The Section 404 Task Force was led by the Assistant Secretary of the Army for Civil Works, and it involved the participation of the President's Office of Management and Budget, the Environmental Protection Agency, the Department of the Interior and the Department of Commerce, and other selected agencies. The Task Force's objective was to attempt to minimize the regulatory burden imposed on developers by the Section 404 Program and also to maintain protection of wetlands.

The authorization for the Clean Water Act expires at the end of fiscal year 1982. As a result, the Task Force had two options available for accomplishing its objective; it could either change the Section 404 Program legislatively or, administratively, it could alter existing regulations and Memoranda of Understanding.

The Task Force on Regulatory Relief announced on May 7, 1982, that it intended to initiate reforms to COE's permit program by administratively reforming Federal procedures under both Section 404 and Section 10 of the Rivers and Harbors Act. The primary thrust of these reforms is directed to reducing the delay in COE's response to permit requests. Specific reform proposals include "eliminating the multi-level bureaucratic review procedure, expanding the use of general permits, giving States more authority and responsibility for permit decisions, and clarifying the scope of the permit program" (Office of the Vice-President, 1982). The Task Force anticipates implementation of its proposed reforms within 6 months.

BARRIER ISLANDS IN THE GULF OF MEXICO

Barrier islands are a common landform along the Gulf Coast. These islands consist of sand and other loose sediments that have been and continue to be transported by wind and water action. In geological terms, barrier islands are a young phenomenon; they were formed only in the last 5,000 or 6,000 years. Barrier islands protect lagoons, salt marshes, estuarine systems, and the mainland from the direct attack of ocean waves and storm surges. On the ocean side, they face and absorb the force of ocean energy. On the land side, they face calm waters and shore that result from the physical barrier formed by the island itself. The term "barrier island" also includes the barrier spit--a landform attached to the mainland at one end, forming a small peninsula. Barrier spits can become barrier islands when a channel severing the connection with the mainland is created by a storm.

Brackish, relatively quiet bays and estuaries lie between the barrier island and the mainland. The waters in these bays and estuaries, a blend of the terrestrial-freshwater systems of the mainland the the saltwater system of the ocean, are among the richest ecosystems known. Many of the species that inhabit the bays, estuaries, and adjacent marshes use these areas as spawning, nursery, and feeding grounds. It is estimated that "two thirds of the top-value Atlantic and Gulf Coast species of fish are directly dependent in some stages of life on conditions of the estuaries" (Clark, 1976).

An example of the importance of these marsh, bay, and estuarine systems is the Apalachicola Bay System of northwestern Florida. This bay, protected by St. Vincent and St. George Islands, receives a flow of fresh water and a supply of nutrients from the Apalachicola River that support a high level of plankton productivity. The Apalachicola Bay System provides over 80 percent of the State's oysters and serves as one of the most productive areas of blue crab propagation along the Gulf Coast of Florida. In addition, this bay system is a major nursery of penaeid shrimp and a broad range of invertebrates and finfish that supply extensive commercial and sport fisheries (DOI, Heritage Conservation and Recreation Service, 1978).

Another benefit of both the islands and their adjacent marshes and bays is that of providing habitats for a large number of birds and other animals. At various points, especially along the mid- and southern Atlantic coast and the Gulf coast, large numbers of birds find wintering habitats.

The islands also provide habitat for several threatened or endangered species, for example, the loggerhead turtle, the southern bald eagle, alligators, and brown pelicans. Table 14 lists the number of barrier islands by Gulf and Atlantic Coast State, along with barrier island acreage by State. Figure 13 shows the barrier islands of the Gulf Coast.

One of the characteristic features of barrier islands is their instability. Because the islands are composed of unconsolidated and shifting sands, they migrate along the coast in response to littoral currents as well as a gradually rising sea level. These trends are greatly accelerated by coastal storms. These storms bring with them increased tides, which are often followed by large waves (storm surges) up to 30 to 40 feet (9.1-12 m) high or higher, which sweep over the island, creating new channels and contours. (Hurricane Carla eroded some shorelines 800 feet (244 m).) The transient, migratory nature of the barrier island landform is essential to its role as the first line of defense of the mainland. The impact of storm waves and hurricane surges on the shore is greatly reduced by the barrier effect of the island. Many harbors and coastal communities along low-lying portions of the Gulf Coast owe their permanence to such protection.

Left intact, undeveloped barrier islands are able to absorb the energy of major storms without long-term damage to their ecosystems. The problem comes with the introduction of permanent, man-made structures on barrier islands.

On April 28, 1981, legislation was introduced in Congress to prohibit Federal expenditures and financial assistance for commercial and residential growth on undeveloped barrier islands along the Atlantic and Gulf coasts. Legislators have said that the Federal Government spent nearly $500 million in Federal grants, loan guarantees, and Federal flood insurance between 1976 and 1978 on barrier island development. Without redirection of this Federal policy, the government will spend an estimated $4 billion to $11 billion over the next 20 years to aid development on only half of the coastal barrier islands presently undeveloped.

Prohibited Federal expenditures would include funds for construction of sewers and roads, new loans for home construction and economic development, new shoreline erosion and stabilization projects except for emergencies, and new Federal flood insurance policies

TABLE 14.—Barrier islands of the Gulf and Atlantic Coasts

State	Number of islands	Total acreage
Alabama	5	28,200
Connecticut	14	2,362
Delaware	2	10,100
Florida	80	467,710
Georgia	15	165,600
Louisiana	18	41,120
Maine	9	2,640
Maryland	2	14,300
Massachusetts	27	37,600
Mississippi	5	9,500
New Hampshire	2	1,100
New Jersey	10	48,000
New York	15	30,310
North Carolina	23	146,400
Rhode Island	6	3,660
South Carolina	35	144,150
Texas	16	383,500
Virginia	11	68,900
18 States	295	1,605,152

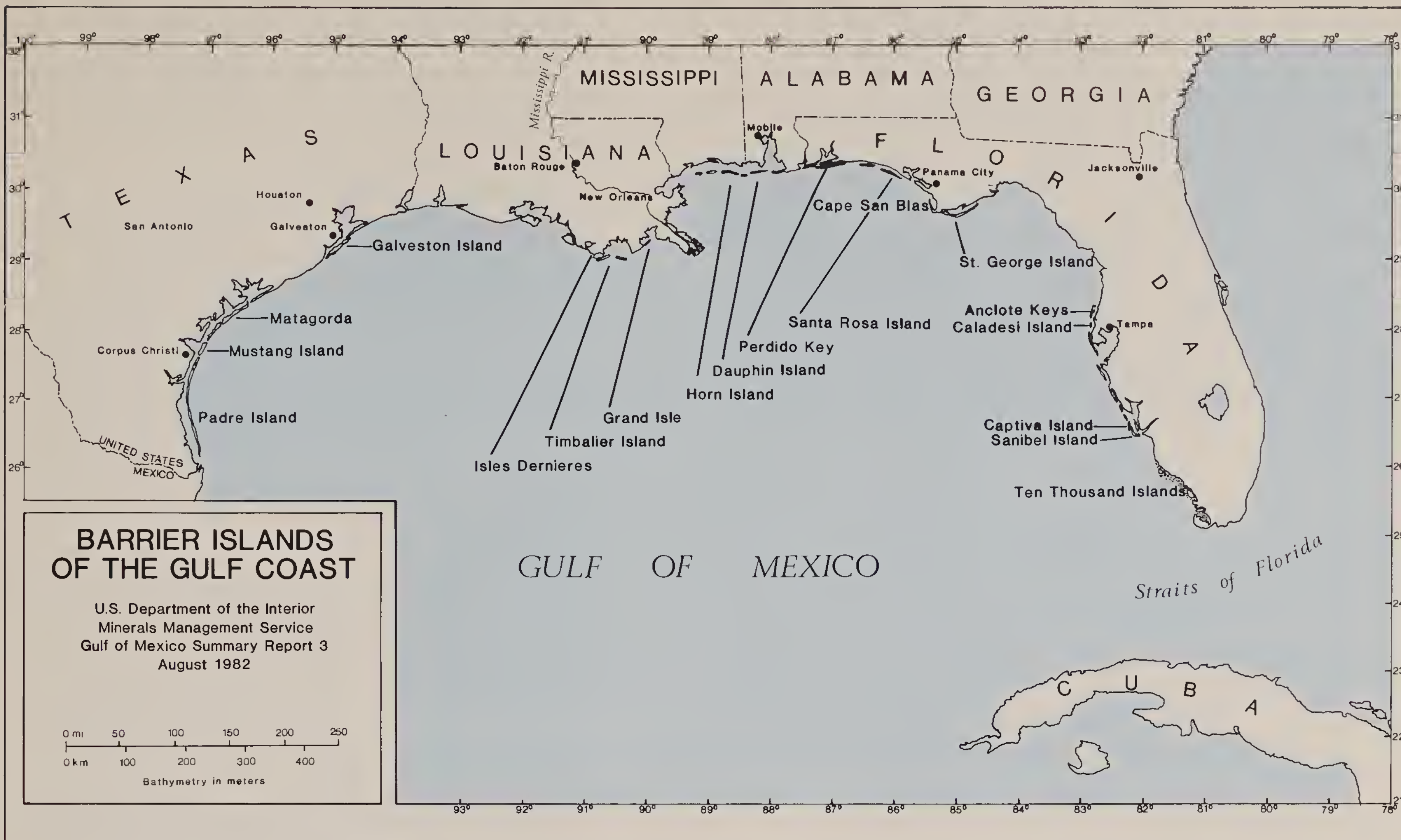

FIGURE 13.--Representative examples of barrier islands of the Gulf Coast. (Redrafted from DOI, Heritage Conservation and Recreation Service, 1981, by Rogers, Golden & Halpern, 1982.)

for new construction or substantial improvements. Exceptions to prohibited expenditures would include funds for energy facilities, maintenance of navigation channels, air and water navigation aids, and emergency disaster assistance. The legislation would not prohibit Federal permits for dredge and fill projects or sewage disposal, and it would not preempt local government zoning and permitting authorities.

The Department of the Interior has produced a set of maps identifying undeveloped U.S barrier islands that would be prohibited from receiving Federal funds under the proposed rule. Additional information on these maps can be found in appendix A.

Planners reviewing proposals for such OCS-related projects as service bases or pipelines on barrier islands should be aware of the natural characteristics of barrier islands and the consequences of development. Barrier islands are physically unstable, migrating landforms. As such, they do not readily support construction of permanent structures or pipelines. The movement of sand under and around a pipeline can cause the line to sag, bend, and perhaps rupture. A line that was buried may, in time, become exposed.

Service bases on barrier islands may create problems with the groundwater. Equipment at the base, as well as personnel, could be subjected to harsh storms, and securing facilities and equipment and evacuating workers may be difficult.

REGIONAL PLANNING IN THE GULF OF MEXICO

Presented below is a listing of regional planning agencies and commissions located in the coastal States of the Gulf of Mexico. This list is provided for those wishing further infor-

mation on a specific region in the Gulf of Mexico. The charters and objectives of these groups vary to a degree, but they often serve as a referral center as well as a direct source of information. Additional information on State and Federal agencies and commissions and their involvement in the Federal OCS leasing process can be found in the companion document to this publication, the **Gulf of Mexico Index.** The Gulf of Mexico Index can be obtained from the Minerals Management Service's Office of OCS Information by returning a postcard provided on the back page of this publication.

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Appendix C. Offshore Issues in the Gulf of Mexico

Appendix C contains a brief review of a series of selected offshore issues and activities. This appendix has been provided at the request of several Gulf Coast planners that were interveiwed in the preparation of this report.

Offshore boundary delimitation efforts in the Gulf of Mexico has a long history, which is briefly outlined here together with relevant court citations for reference purposes. Appendix C also contains a brief review of the Marine Sanctuaries Program and oil spill response measures.

OFFSHORE BOUNDARY DELIMITATION IN THE GULF OF MEXICO

A review of factors affecting the magnitude and timing of OCS development might appropriately include an analysis of ownership rights and management authority for the submerged lands upon which this development occurs. As a common property resource, the OCS is owned by the American public and is held in trust by governmental entities. Development activities on the OCS are managed by these entities to provide the public with a fair market return for non-renewable resources extracted by private concerns. Through a series of judicial and legislative events that have occured during the past 35 years, as outlined below, ownership rights and management authority over submerged lands were divided between the Federal and coastal State governments.

This split in ownership rights and management authorities has necessitated the delineation of boundaries to clearly identify the line of transition from coastal State to Federal authority. The need for delimitation, though important for the purposes of identifying the range of management authority, has been magnified by the dramatic increase in marine resource exploitation. This importance derives largely from the ability of the manager to exact rents, royalties, and a variety of taxes from the relevant extractive industries.

Uncertainties over the legal delimitation between the Federal and coastal State government's authority have several distinct disadvantages. Extensive amounts of time, money, and human resources can be, and have been, spent in litigation between these two levels of government to establish the existence and extent of their respective ownership rights over submerged offshore lands. Furthermore, extractive industries themselves may avoid areas offered for lease if these areas are subject to legal uncertainty. Such uncertainty can affect strategic planning for activities on that lease and ultimately development itself. Any such inhibition may deprive the public of the offshore resources and revenues derived from their extraction.

Though efforts have been made to adjudicate and legislatively segregate the ownership rights and management authorities of the Federal and coastal State governments, some uncertainty remains. The precise locations of the boundaries delineating the transition between these authorities have long been subject to competing claims. The dispute between the coastal States and the Federal Government over ownership rights of submerged lands came to be known as the "tidelands controversy." The genesis of this dispute coincided with the advent of oil production off California, on leases issued by that State. Previously, the Federal Government had vacillated in its view of who owned the submerged lands (Shalowitz, 1962). With the advent of

production, however, the Federal Government initiated proceedings against the State of California in the U.S. Supreme Court (**United States** v. **California**; 332 U.S. 19 (1947)). In this case, the Supreme Court decreed that the Federal Government had paramount rights in all submerged lands seaward of low tide elevations.

In similar proceedings, the U.S. Government sought to invalidate the claims of the States of Louisiana and Texas to submerged lands adjacent to their coasts (**United States** v. **Louisiana**; 339 U.S. 699 (1950) & **United States** v. **Texas**; 339 U.S. 707 (1950)). In a joint decree entered on December 11, 1950, the U.S. Supreme Court again ruled in favor of the Federal Government (340 U.S. 899,900). Together these three cases came to be known as the "submerged lands cases." These decisions both resolved the question of the ownership of submerged lands and served to assert the validity of the U.S. claim to jurisdiction over the Continental Shelf under the Truman Proclamations of September 28, 1945 (Shalowitz, 1962).

Subsequent to the "submerged lands cases," and a Presidential election fueled in part by the tidelands controversy, Congress, in 1953, passed the Submerged Lands Act (67 Stat. 29). This Act granted to coastal States ownership rights and title to "lands beneath navigable waters" to a point 3 nautical (geographic) miles (5.6 km) from the ordinary low tide line (Section 2(a) (2)). An exception was made for any Gulf Coast State whose offshore boundary extended farther seaward than 3 nautical miles (5.6 km) at the time that State was admitted to the Union, or if that boundary had previously been agreed to by Congress. The Submerged Lands Act, therefore, effectively reversed the Supreme Court's decisions in the "submerged lands cases." The Supreme Court later reviewed the constitutionality of the Act and affirmed the right of Congress to dispose of those lands previously determined to be Federal property (**Alabama** v. **Texas et al.**, and **Rhode Island** v. **Louisiana et al.**, 347 U.S. 272 (1954)).

The ambiguity of the statutory language in the Submerged Lands Act opened the potential for a multitude of claims beyond 3 nautical miles (5.6 km). In the Gulf of Mexico region, the extent of the submerged lands grants made to each coastal State under this Act was determined by the U.S. Supreme Court in a consolidated proceeding (**United States** v. **Louisiana, Texas, Mississippi, Alabama,** and **Florida**; 363 U.S. 1 (1960)), although a separate opinion was issued for Florida (363 U.S.121) (Shalowitz, 1962). The decision in the consolidated Gulf of Mexico submerged lands grant cases was delivered on May 31, 1960. The decision held that Texas and Florida were entitled to grants of 3 marine leagues (approximately 10.5 nautical miles or 17 km) but that Louisiana, Mississippi, and Alabama were entitled to only 3 nautical miles (5.6 km) (**United States** v. **Louisiana et al.**; 363 U.S. at 64, 79, 82, and 129) (Shalowitz 1962). To date, no further judicial interpretation of the extent of the submerged lands grants in the Gulf of Mexico region has been made.

This is not to say that adjudication involving Gulf of Mexico submerged land grants has not continued. On the contrary, litigation continues to date. This litigation primarily has involved two issues. The first issue to be litigated has involved locating the exact coastal boundary from which the submerged land grant and/or territorial sea is measured, and the second issue involves section 8(g) of the OCS Lands Act Amendments of 1978. Locating the coastal boundary assumes a greater importance in the Gulf region because of the proximity of offshore hydrocarbons and geologic irregularities of the coast. Much of the Gulf coastline is fringed by barrier islands or is highly irregular.

The State of Louisiana, in particular, has been involved in a series of lawsuits with the U.S. Government following the 1960 Supreme Court decree that established each Gulf Coast State's submerged lands grant (43 Louisiana Coastal Law). In a 1975 supplemental decree to this case, the U.S. Supreme Court (**United States** v. **Louisiana et al.**, 422 U.S. 13 (1975)), established Louisiana's legal shoreline. In a final decree, issued in 1981 by the Supreme Court, Louisiana's coastline was declared ambulatory, and the territorial sea/submerged lands grant delineation was established. An ambulatory boundary is subject to readjudication due to erosion. The problem of coastal

erosion was discussed in appendix B of this report.

The State of Texas has an established coastal baseline. In 1960, the Supreme Court, in **United States** v. **Louisiana et al.**, confirmed the "historic shoreline" of Texas, from which the territorial sea and submerged lands grant were to be measured. This baseline was also determined to be ambulatory. The precise boundary of Texas' submerged lands grant has not been determined, but no litigation has been initiated to resolve this question. In an effort to expedite the development of hydrocarbon resources in the vicinity of the assumed outer limit of Texas submerged lands grant, Texas and the Department of the Interior have developed an informal administrative agreement, via exchange of letters, for leasing areas immediately adjacent to this line (Collier, 1982, oral commun.).

As previously noted, the States of Alabama and Mississippi were granted submerged lands extending 3 nautical miles (5.6 km) into the Gulf of Mexico by the 1960 U.S. Supreme Court decree. At present, however, both Mississippi and Alabama are involved in active litigation with the United States over the Department of the Interior's inclusion of "Federal enclaves" within Mississippi Sound, in the OCS Official Protraction Diagram NH 16-4 Mobile, for OCS Lease Sale 62. Inclusion of these enclaves, though subsequently removed from the offering, indicated a U.S. claim to submerged lands within the sound that Mississippi and Alabama had regarded as State owned. Mississippi and Alabama requested a supplemental ruling on the 1960 **United States** v. **Louisiana et al.** case in October 1979. The Supreme Court has appointed a special master to hear initial arguments and report the facts to the court. Initial hearings were held in June 1982. A final resolution of this case is before the Supreme Court expected in late 1983 or early 1984 (Bruce, 1982, oral comm.)

The dispute in this case results from the application of different definitions of the term "inland waters." The Submerged Lands Act did not define "inland waters." This definition becomes important when a State's coastline is fringed by islands or is indented by a wide river mouth or bay. Mississippi and Alabama are fringed by barrier islands ranging 3 to 10 nautical miles (5.6-17 km) from the mainland. Alabama and Mississippi use these islands as their historic baseline. The U.S. Government, however, maintains that these States' coastal low tide elevation is the baseline and that each island has a 3-nautical-mile (5.6-km) belt surrounding it that also belongs to the States.

The 1960 Supreme Court decreed, in **United States** v. **Louisiana et al.**, that Florida was granted property rights over submerged lands extending 3 marine leagues (17 km) into the Gulf of Mexico. Subsequent litigation in the case **United States** v. **Maine** (420 U.S. 515 (1975)) set Florida's Atlantic submerged lands grant at 3 nautical miles (5.6 km). Because industry interest in the eastern Gulf OCS off Florida has, historically, been far beyond 3 marine leagues (17 km) from the coast, no events have occurred that would have precipitated action to resolve the baseline and outer extremity of this grant. Any effects the accelerated OCS leasing schedule proposed by the Department of the Interior will have on this matter remain to be seen.

The second issue to be litigated in the Gulf region relating to boundaries is the section 8(g) lawsuits, at the District Court level, involving the Gulf Coast States of Texas and Louisiana and the United States (**State of Texas** v. **Watt et al.**, Civil No. B-79-476-CA, Eastern District Court of Texas; & **State of Louisiana** v. **Watt et al.**, Civil No. 79-2965-I(2), Eastern District Court of Louisiana). Both of these cases were filed on July 27, 1979. These lawsuits derive from different interpretations of section 8(g) of the 1978 amendments to the Outer Continental Shelf Lands Act (43 USC 1337(g)).

Section 8(g) establishes a 3-nautical-mile (5.6-km) buffer beyond the presumed Federal-State marine boundary. The Secretary of the Interior is directed to provide the Governor of the State adjacent to a lease offered in this 8(g) zone an opportunity to enter into an agreement for the "fair and equitable" division of revenues from that lease. Further, the Secretary shall determine whether any areas subject to lease have oil or gas pools or fields underlying both Federal and State waters. Section 8(g) is premised on the likelihood that

a hydrocarbon field could be split by the Federal-State boundary and that development of one side of this boundary could deprive the other party of resources rightfully theirs. Any revenues derived from an 8(g) lease is deposited into an interest-bearing escrow account until agreement is reached as to its disposition or until an award through litigation is made. Section 8(g) litigation in the Gulf of Mexico alone involves the disposition of $2.5 billion. The States of California and Alaska are also pursuing section 8(g) litigation against the Department of the Interior.

It should be noted that the terms "submerged lands grant" and "territorial sea" are not synonymous in this region of the United States because of the Supreme Court's ruling on Texas and Florida. The limit to the U.S. territorial sea historically has been, and is at present, set at 3 nautical miles (5.6 km). Within the territorial sea, the Federal Government "...retains all its navigational servitude and rights in and powers of regulation and control...for the constitutional purposes of commerce, navigation, national defense, and international affairs..." (67 Stat. 29; Section 6(a)). The territorial sea is always 3 nautical miles (5.6 km) and cannot be equated with the phrase "submerged lands grant" because of the 3 marine league (17 km) grants to Texas and Florida. State management authorities under the Submerged Lands Act relate only to the natural resources of the seabed, subsoil, and overlying waters. State regulatory authorities, such as those conferred by Congress to coastal States from the Coastal Zone Management Act, invariably apply only to the territorial sea--3 nautical miles (5.6 km).

This clarification between the limit to the territorial sea and submerged lands grants should be clearly understood. This distinction will become important if the United States should, at a future date, expand the limit of the territorial sea to 12 nautical miles (22 km). Though the 3-mile (5.6-km) limit to the territorial sea has been the historic international norm, recent developments indicate that there may be a shift in the extent of this limit. Presently, those nations claiming a 12-nautical-mile (22-km) territorial sea outnumber nations claiming 3 nautical miles (5.6 km) by a ratio of about 4 to 1 (U.S. Department of State, 1981). Should any change to the limit of the U.S. territorial sea occur, an uncertainty would be created as to the jurisdictional extent of coastal States' ownership rights and management authority therein.

Through three United Nations-sponsored conferences on the law of the sea, the nations of the world have attempted to establish the outer limits for several marine jurisdictional zones. During the Third U.N. Conference on the Law of the Sea (UNCLOS III), a wide consensus developed on setting the outer limit to the territorial sea at 12 nautical miles (22 km). The United States accepted this proposed limit with selected reservations connected to other portions of the draft treaty.

When the Reagan Administration assumed authority in 1981, an extensive review of the draft treaty was undertaken. Though the 12-mile (22-km) limit was not repudiated during this review, several articles of the draft treaty were deemed unacceptable to U.S. interests. During the first session of 1982, an impasse was reached in the deliberations at UNCLOS III between the United States, joined by several other industrialized nations, and the so-called "Group of 77"--composed of representatives of the developing nations--on articles dealing with deep seabed mining of manganese nodules. Because of these differences, the United States asked that the treaty, as a whole, be put to a vote. On April 30, 1982, the delegates to UNCLOS III adopted the draft treaty by a vote of 130 nations in favor, 17 abstaining, and 4 against. The United States was joined by Israel, Turkey, and Venezuela in voting against adoption of the draft treaty.

The UNCLOS III treaty will be opened for signature in Caracas, Venezuela, during December of 1982. President Reagan announced on July 9, 1982, that the United States would not sign either the final act of the conference or the draft treaty itself. What effect this will have on U.S. acceptance of selected portions of the treaty, including the 12-nautical-mile (22-km) limit, remains to be seen. Certain portions of the UNCLOS III treaty may become part of customary international law, as evidenced by the practices of the nations of the world.

While it remains premature to speculate on U.S. adoption of a 12-nautical-mile (22-km) territorial sea, any such adoption would not immediately expand a coastal State's submerged lands grant. An expansion of State ownership rights and management authority would require congressional amendment to the Submerged Lands Act and numerous other statutes.

MARINE SANCTUARIES IN THE GULF OF MEXICO

The National Oceanic and Atmospheric Administration's (NOAA) Office of Coastal Zone Management is authorized to carry out the provisions of Title III of the Marine Protection, Research and Sanctuaries Act of 1972, as amended in 1980. Title III mandates a national program to designate ocean areas as marine sanctuaries. Marine sanctuaries are created to preserve or restore the conservation, recreational, ecological, or esthetic values of regionally selected marine areas. The Marine Sanctuaries Program offers environmental protection for selected areas that would not otherwise be statutorily available.

NOAA's Marine Sanctuaries Program in January 1982 began distributing a new National Marine Sanctuary Program Development Plan. This new plan refined the program's mission, goals and objectives, administration, operational criteria, and enforcement and regulatory authorities.

Eight regional resource evaluation teams have been established, in concert with the new approach to sanctuary screening, to identify, evaluate, and recommend three to five sites within their region for inclusion on NOAA's site evaluation list. If a candidate area is selected for the list, the public is notified and briefed through the Federal Register. After further analysis, if a site is still a viable candidate, NOAA places this site on its active candidates list, notice is again made to the public through the Federal Register, and a regional scoping meeting is held. Next, a draft environmental impact statement and management plan is distributed and a public hearing is held. Following consultations from this last phase, a final environmental impact statement and management plan is distributed, and the public is again notified through the Federal Register. If the President concurs with this final nomination, the sanctuary is officially designated and the management plan is implemented.

Further information on the Marine Sanctuaries Program, the regional resource evaluation teams, and copies of the Program Development Plan can be obtained by writing or phoning:

Sanctuaries Program Office
Office of Coastal Zone Management
National Oceanic and Atmospheric Administration
3300 Whitehaven Street, N.W.
Washington, D.C. 20235
(202) 634-4236

Gulf of Mexico Regional Resource Evaluation Team

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OIL SPILL RESPONSE MEASURES

Government

Under the Federal Water Pollution Control Act, the government has assigned the Environmental Protection Agency and the U.S. Coast Guard responsibility for coordinating the Nation's capability to combat an oil spill. The Coast Guard's Gulf Strike Team, based at

Bay St. Louis, Mississippi, is equipped with state-of-the-art equipment designed to contain and clean up oil in 5-foot (1.5-m) seas, 20-knot winds, and 1.5-knot currents; however, this equipment has proven effective in 10-foot (3.0-m) seas and 40-knot winds. The strike team has the capability to deploy equipment and personnel within hours of notification of a spill.

A memorandum of understanding between the Department of Transportation and the Department of the Interior outlines the respective responsibilities of the U.S. Coast Guard and the Minerals Management Service regarding the supervision of abatement, containment, and cleanup operations required by OCS Operating Order No. 7. Essentially, the Minerals Management Service is responsible for the coordination and direction of abatement measures, and the U.S. Coast Guard is responsible for supervising industry's containment and removal operations.

Industry

Under the Clean Water Act of 1977, oil companies operating offshore are responsible for cleaning up all oil spills that may occur as a result of their offshore operations. In addition, USGS Gulf of Mexico Operating Order No. 7 requires that an operator submit an oil spill contingency plan to the Minerals Management Service Deputy Minerals Manager prior to approval of permit application for conducting operations. This plan must be reviewed annually.

Because of the high cost of maintaining oil spill cleanup equipment and response personnel, oil companies operating in the Gulf of Mexico have joined together into an oil spill cooperative that owns and shares equipment and personnel. Clean Gulf Associates, a group of about 63 companies (membership varies from time to time), maintains equipment at strategic locations in a state of 24-hour readiness and evaluates technological advances for possible inclusion in their equipment stockpile. The cooperative has established bases of operation at Venice, Grand Isle, Houma, Intracoastal City, and Cameron, Louisiana, and at Galveston and Rockport, Texas. Additional bases at Panama City and Bradenton, Florida, can be activated in the event of an oil spill in the eastern Gulf (BLM, New Orleans OCS Office, 1981a). Figure 14 shows the locations of staging sites of the oil spill cooperative.

FIGURE 14.--Locations of staging sites of Clean Gulf Associates Cooperative. (Redrafted from BLM, New Orleans OCS Office, 1980, by Rogers, Golden & Halpern, 1982.)

Glossary

Definitions presented in this glossary describe terms as they have been used in this summary report. The glossary is intended for general reference only: for detailed descriptions of technical or specialized terms, the reader should seek a reference in the field of particular interest. Abbreviations and acronyms are presented in tabular form on p. iv.

Sources used in compiling this glossary were the initial Gulf of Mexico Summary Report; other Office of Outer Continental Shelf Information summary reports and indexes, Webster's Third International Dictionary, the American Geological Institute's Dictionary of Geological Terms, and Langenkamp's Handbook of Oil Industry Terms and Phrases (2nd ed.).

Anticline - An upfold or arch of stratified rock in which the beds or layers bend downward in opposite directions from the crest or axis of the fold.

API gravity - Gravity (weight per unit of volume) of crude oil or other liquid hydrocarbon measured by a system recommended by the American Petroleum Institute.

Arenite - Consolidated rock having the texture of sand irrespective of composition.

Associated gas - Free natural gas, occuring as a gas cap, in contact with and above an oil accumulation within the reservoir.

Basement rock - Rock in the earth's crust beneath all sedimentary rocks.

Basin - A depression of the earth in which sedimentary materials accumulate or have accumulated, usually characterized by continuous deposition over a long period of time; a broad area of the earth beneath which the strata dip, usually from the sides toward the center.

Bed - A rock mass, usually of greater horizontal thickness than vertical or near-vertical thickness, bounded (especially on its upper side) by material with different physical properties.

Block - A geographical area of approximately 9 square miles (5,760 acres or 2,330 hectares), which is used in official BLM protraction diagrams or leasing maps.

Blowout - An uncontrolled flow of gas, oil, and other fluids from a well to the atmosphere. A blowout occurs when formation pressure exceeds pressure applied to the well by the column of drilling fluid.

Blowout preventer - A stack or an assembly of heavy-duty valves attached to the top of the well casing to control well pressure.

Bonus - Money paid by the lessee for the execution of an oil and gas lease.

Btu - British thermal unit, a measure of thermal energy.

Casing - Steel pipe used in oil wells to seal off fluids in the rocks from the bore hole and to prevent the walls of the hole from sloughing off or caving.

CEIP - Coastal Energy Impact Program, administered by the Office of Coastal Zone Management of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Clastic - Consisting of fragments of rocks or organic structures that have been moved individually from their places of origin.

Compaction - Decrease in volume of sediments as a result of compressive stress, usually resulting from continued deposition above them but also from drying and other causes.

Completion - Conversion of a development well or an exploratory well into an oil and/or gas production well.

Condensate - Liquid hydrocarbons produced with natural gas that are separated from the gas by cooling and various other means. Condensate generally has an API gravity of 50 to 120 degrees and is water-white, straw, or bluish in color.

Consolidation - involves requiring offshore operators to consolidate onshore operations, particularly processing operations.

Continental Margin - A zone separating the emergent continents from the deep sea bottom.

Continental Shelf - A broad, gently sloping, shallow feature extending from the shore to the Continental Slope.

Continental Slope - A relatively steep, narrow feature paralleling the Continental Shelf; the region in which the steepest descent to the ocean bottom occurs.

Contingency plan - A plan for possible offshore emergencies prepared and submitted by the oil or gas operator as part of the plan of development and production.

Delineation well - An exploratory well drilled to define the areal extent of a field. Also referred to as an "expendable well."

Development - Activities that take place following exploration for, discovery of, and delineation of minerals in commercial quantities, including but not limited to geophysical activity, drilling, platform construction, and operation of all directly related onshore support facilities; and that are for the purpose of ultimately producing the minerals discovered.

Development and production plan - A plan describing the specific work to be performed, including all development and production activities that the lessee(s) propose(s) to undertake during the time period covered by the plan and all actions to be undertaken up to and including the commencement of sustained production. The plan also includes descriptions of facilities and operations to be used; well locations; current geological and geophysical information; environmental safeguards; safety standards and features; time schedules; and other relevant information. Under 30 CFR 250.34-2, all lease operators are required to formulate and obtain approval of such plans by the Director of the U.S. Geological Survey before development and production activities may commence.

Diapir - A piercing fold; an anticlinal fold in which a mobile core, such as salt, has broken through the more brittle overlying rocks.

Discovery - The initial find of significant quantities of hydrocarbons.

Dissolved gas - Natural gas dissolved in crude oil within the reservoir.

Dome - A roughly symmetrical upfold, the beds dipping in all directions, more or less equally, from a point; any structural deformation characterized by local uplift approximately circular in outline, for example, the salt domes of Louisiana and Texas.

Drainage sale - A lease sale held to protect either Federal or State acreage from drainage by development on nearby tracts in the other jurisdiction.

Drilling mud - A special mixture of clay, water, or refined oil, and chemical additives pumped downhole through the drill

pipe and drill bit. The mud cools the rapidly rotating bit; lubricates the drill pipe as it turns in the well bore; carries rock cuttings to the surface; serves as a plaster to prevent the wall of the bore hole from crumbling or collapsing; and provides the weight or hydrostatic head to prevent extraneous fluids from entering the well bore and to control downhole pressures that may be encountered.

Drill pipe - Heavy, thick-walled steel pipe used in rotary drilling to turn the drill bit and to provide a conduit for the drilling mud.

Drillship - A self-propelled, self-contained vessel equipped with a derrick amidships for drilling wells in deep water.

Economically recoverable resource estimate - An assessment of the hydrocarbon potential that takes into account (1) physical and technological constraints on production and (2) the influence of costs of exploration and development and market price on industry investment in OCS exploration and production.

En echelon - Faults having parallel but steplike trends.

Enhanced recovery techniques - Recovery methods for crude oil that include water flooding, steam and gas injection, micellular-surfactant, steam drive, polymer, miscible hydrocarbon, carbon dioxide, and steam soak methods. Enhanced recovery techniques are not restricted to secondary or even tertiary projects: some fields require the application of one of the above methods even for initial recovery of crude oil.

Environmental impact statement (EIS) - A statement required by the National Environmental Policy Act of 1969 (NEPA) or similar State law in relation to any action significantly affecting the environment.

Erosion/scour - A loosening or dissolution of the seabed by high-velocity bottom currents, particularly those caused by storms. Erosion and scour can mobilize sand and result in significant horizontal crest and trough displacements. Lateral migration of the crest can "strand" platform supports or wellhead plumbing by eroding the surrounding support materials.

Eustatic - Of or pertaining to worldwide sea level.

Eutrophic - Refers to lakes with little oxygen in the bottom waters and much nutrient matter.

Exploration - The process of searching for minerals. Exploration activities include (1) geophysical surveys where magnetic, gravity, seismic, or other systems are used to detect or infer the geologic conditions conducive to the accumulation of such minerals and (2) any drilling, except development drilling, whether on or off known geological structures. Exploration also includes the drilling of a well in which a discovery of oil or natural gas in paying quantities is made and the drilling of any additional well after such a discovery that is needed to delineate a reservoir and to enable the lessee to determine whether to proceed with development and production.

Exploration plan - (See **plan of exploration**).

Facies - A lateral subdivision based on lithologic differences of a stratigraphic unit.

Fan - An accumulation of sediment transported downward in a relatively high-energy, constricted environment and debouching onto a low-energy, unconstricted surface, forming a widespread deposit of low relief.

Fault - A fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other.

Feedstock - Crude oil or other hydrocarbons that are the basic materials for a refining or manufacturing process.

Field - An area within which hydrocarbons have been concentrated and trapped in economically producible quantities in one or more structural or stratigraphically related reservoirs.

Geochemical - Of or relating to the science dealing with the chemical composition of and the actual or possible chemical changes in the crust of the earth.

Geologic hazard - A feature or condition that may seriously jeopardize offshore oil and gas exploration and development activities. It may necessitate special engineering procedures or relocation of the proposed development.

Geologic trap - An arrangement of rock strata, involving their structural relations or varied lithology and texture, that favors the accumulation of oil and gas.

Geomorphic - Of or pertaining to surface landforms.

Geomorphology - The science of surface landforms and their interpretation on the basis of geology and climate.

Geophysical - Of or relating to the physics of the earth, especially the measurement and interpretation of geophysical properties of the rocks in an area.

Geophysical survey - The exploration of an area in which geophysical properties and relationships unique to the area are measured by one or more geophysical methods.

Geosyncline - Large, generally linear trough that subsided deeply throughout a long period of time in which a thick succession of stratified sediments and possibly extrusive volcanic rocks commonly accumulated.

Growth curve - A graphic representation of the relative growth of a population during a sequence of similar-length periods.

Homoclinal - Characterized by beds dipping uniformly in one direction.

Hydrocarbon - Any of a large class of organic compounds containing primarily carbon and hydrogen, comprising paraffins, olefins, members of the acetylene series, alicyclic hydrocarbons, and aromatic hydrocarbons, and occurring in many cases in petroleum, natural gas, coal, and bitumens.

Intrusion - A body of igneous rock resulting from solidification of the intruding magma; the plastic injection of masses of salt or shale into overlying rocks; magma, shale, or salt injected into overlying rocks.

Jacket - A supporting structure for an offshore platform consisting of large-diameter pipe welded together with pipe braces to form a multilegged stool-like structure. The jacket is secured to the ocean floor by pilings driven through the legs. The multilegged platform is then fitted into the jacket and secured.

Jack-up - A bargelike, floating platform with legs at each corner that can be lowered to the sea bottom to raise the platform above the water.

Karst - A limestone plateau marked by sinks interspersed with abrupt ridges and irregular protuberant rocks, usually underlain by caverns and underground streams.

Lagoon - A shallow sound, channel, pond, or lake near or communicating with the sea or with a larger lake or a river and partly or completely separated from it by a low, narrow, elongated strip of land such as a reef, barrier island, sand bank, or spit.

Landfall - The site at which a marine pipeline comes to shore.

Land use - The function for which people employ an area of land.

Lay barge - A shallow-draft, bargelike vessel used in the construction and laying of underwater pipelines.

Lease - A contract authorizing exploration for and development and production of minerals; the land covered by such a contract.

Lease sale - The public opening of sealed bids made after competitive auction for leases granting companies or individuals the right to explore for and develop certain minerals within a defined period of time.

Lease term - For oil and gas leases, a period of either 5 years or up to and exceeding 10 years (when a longer period is necessary to encourage exploration and development in areas because of unusually deep water or other adverse conditions (see **primary term**)).

Lighter - A barge or small tanker used to move cargo from a large ship to port; also, to transport by lighter.

Liquefaction - The fluid-like behavior of water-saturated sediments, usually induced by a sudden shock.

Littoral - Belonging to, inhabiting, or taking place on or near the shore.

Logistic curve - A curve representing a function involving an exponential and shaped like the letter S.

Marine sanctuary - Areas protected under the Marine Protection, Research, and Sanctuaries Act of 1972.

Mass movement - Unit movement of a portion of the land surface. Mass movement, or slumping, can occur where unconsolidated sediments are distributed over a steep gradient.

Metamorphosis - The process by which the physical and chemical characteristics of rock are altered by exposure to heat and pressure in the earth's crust.

Module - An assembly that is functional as a unit and can be joined with other units for increasing or enlarging the function; for example, a gas-compressor module.

Mudstone - The lithified equivalent of mud, similar to shale but more massive and less indurated.

Non-associated gas - Natural gas that is not associated with or not in contact with crude oil within a reservoir.

Offlapping - A seaward retreat of a shoreline, where progressively younger strata have been deposited in layers offset seaward.

Offloading - Another name for unloading; offloading refers more specifically to liquid cargo--crude oil, and refined products.

Offshore monobuoy - A buoy system at which a tanker may anchor, discharge, or load petroleum products.

Offshore storage and treatment vessel (OS&T) - A converted tanker anchored by a platform and used to remove natural gas, water, and other impurities from crude oil and to store the treated product until it is offloaded by a shuttle tanker.

Organic matter - Material derived from plant or animal organisms.

Outer Continental Shelf (OCS) - All submerged lands that comprise the Continental Margin adjacent to the United States and seaward of State offshore lands. The OCS has been subject to Federal jurisdiction and control since enactment of the Submerged Lands Act of 1953 (43 U.S.C. 1301 and 1302).

Pays - The subsurface geological formation where a deposit of oil or gas is found in commercial quantities.

Permeability - The ability to transmit fluids.

Petroleum - An oily, flammable bituminous liquid that occurs in many places in the upper strata of the earth, either in seepages or in reservoirs; essentially a complex mixture of hydrocarbons of different types with small amounts of other substances; any of various substances (as natural gas or shale oil) similar in composition to petroleum.

Plan of exploration - A plan based on all available relevant information about a leased area that identifies, to the maximum extent possible, all the potential hydrocarbon accumulations and wells that the lessee(s) proposes(s) to drill to evaluate the accumulations within the entire area of the lease(s) covered by the plan. Under 30 CFR 250.34-1, all lease operators are required to formulate and obtain approval of such plans by the Manager of the Minerals Management Service before exploration activities may commence.

Platform - A steel or concrete structure from which offshore wells are drilled.

Porosity - The capability to contain fluids within void spaces in rock.

Primary term - The initial period of oil and gas leases, normally 5 years (see **lease term**).

Production - Activities that take place after the successful completion of any means for the removal of minerals, including such removal, field operations, transfer of minerals to shore, operation monitoring, maintenance, and work overdrilling.

Production curve - A curve plotted to show the relation between quantities produced during definite consecutive time intervals.

Prograded - A seaward advance of the shoreline, resulting from the nearshore deposition of sediments brought to the sea by rivers.

Proprietary information - Geologic and geophysical data and immediate derivatives thereof that cannot be released to the general public because of Federal law, regulations, or statutes, or because of contractual requirements.

Province - An area throughout which geological conditions have been similar or that is characterized by particular structural, petrographic, or physiographic features.

Recoverable resource estimate - An assessment of oil and gas resources that takes into account the fact that physical and technological constraints dictate that only a portion of resources or reserves can be brought to the surface.

Refining - Fractional distillation, usually followed by other processing (as cracking).

Relief - The elevations or inequalities of a land surface.

Reserve estimate - An assessment of the portion of the identified oil or gas resource that can be economically extracted.

Reserves - Portion of the identified oil or gas resource that can be economically extracted.

Reservoir rock - The rock material in which hydrocarbons accumulate, or whose characteristics are conducive to hydrocarbon accumulation.

Resource - Concentration of naturally occurring solid, liquid, or gaseous materials in or on the earth's crust.

Revenue sharing - A proposed system of sharing Federal revenues generated by hydrocarbon development on the OCS with coastal States.

Rig - Equipment used for drilling an oil or gas well.

Right-of-way - A legal right of passage over another person's land; the strip of land for which permission has been granted to

build a pipeline and for normal maintenance thereafter.

Riser - Connecting pipeline from the sea bottom platform to the platform facilities.

Risked resource estimate - An assessment of oil or gas resources that has been modified to take into account the uncertainty of the estimate and to account for the possibility that economically recoverable resources may not be found within the area of interest.

Risked resources for leased lands - An assessment of oil or gas resources that has been modified to take into account (1) physical and technological constraints on production; (2) the influence of the costs of exploration and development and market price on industry investment in OCS exploration and production; and (3) the uncertainty of the estimate and to account for the possibility that economically recoverable resources may not be found within the area of interest.

Sandstone - A sedimentary rock made up of sand-size grains that usually consist of quartz more or less firmly united by some cement (as silica, iron oxide, or calcium carbonate).

Sediment - Material or a mass of material deposited (as by water, wind, or glaciers).

Sedimentary rocks - Rock formed of mechanical, chemical, or organic sediment.

Seismic - Pertaining to, characteristic of, or produced by earthquakes or earth vibration; having to do with elastic waves in the earth.

Shale - An indurated rock that is formed by the consolidation of clay or mud, has a finely stratified or laminated structure parallel to the bedding, and is composed of minerals that have been essentially unaltered since deposition.

Shear - A stress causing two adjacent parts of a solid to slide past each other parallel to the plane of contact; also, the application of such a stress.

Siliceous - Of, pertaining to, or containing silica or quartz.

Slot - A guide on a drilling platform through which a well is drilled.

Slumping - (See **mass movement**).

Sour crude - Crude containing chemical impurities, notably hydrogen sulfide.

Sour gas - Natural gas containing chemical impurities, notably hydrogen sulfide.

Source bed - Rocks containing relatively large amounts of organic matter that is transformed into hydrocarbons.

Stratum (pl.,strata) - A tabular mass or thin sheet of sedimentary rock formed by natural causes and made up usually of a series of layers lying between beds of other kinds.

Stratigraphic sequence - A succession of sedimentary beds of interregional extent, chronologically arranged with the older beds below and the younger above.

Stratigraphic trap - A geologic feature that includes a reservoir, capable of holding oil or gas, that is formed from a change in the character of the reservoir rock. Such a trap is harder to locate than a structural trap because it is not dependent on structural closure and is thus not readily revealed by geological or geophysical surveys.

Streamlining - A proposed system to shortening the Federal leasing process.

Strike - The direction or bearing of a horizontal line in the plane of an inclined stratum, fault, or other structural plane (for example, the axial plane of an anticline).

Strike-slip-fault - A fault in which the net movement is practically parallel to the direction of the fault trend.

Structural trap - A geologic feature that includes a reservoir, capable of holding oil or gas, that is formed from crustal movements in the earth that fold or fracture rock strata in such a manner that oil or gas accumulating in the strata are sealed off and cannot escape. In some cases "structure" may be synonymous with structural trap.

Subduction - Descent of one tectonic unit under another.

Subsidence - Movement in which there is no free side and surface material is displaced vertically downward with little or no horizontal component; a sinking of a large part of the earth's crust.

Subsurface geology - The study of structure, thickness, facies, correlation, etc. of rock formations beneath land or seafloor surfaces.

Summary report - Document prepared by the Department of the Interior pursuant to 30 CFR 252.4 that is intended to inform affected State and local governments as to current OCS reserve estimates, projections of magnitude and timing of development, transportation planning, and general location and nature of nearshore and onshore facilities.

Supply boat - Vessel that ferries food, water, fuel, and drilling supplies and equipment to a rig and returns to land with refuse that cannot be disposed of at sea.

Surficial - Characteristic of, pertaining to, formed on, situated at, or occuring on the earth's surface; especially, consisting of unconsolidated residual, alluvial, or glacial deposits lying on the bedrock.

Surge tank - A tank on a flow line whose function is to receive and neutralize sudden intermittent rises or surges in the stream of liquid.

Swapping - Exchange of crude oil among companies to facilitate refining when one company's production is closer to the other's refinery, or vice versa.

Sweet gas - Natural gas free of significant amounts of hydrogen sulfide when produced.

Tectonic - Of or pertaining to the rock structure and external forms resulting from the deformation of the earth's crust.

Thrust fault - A reverse fault having a low angle of inclination with reference to a horizontal plane.

Tract - The geographic and legal extent of a single lease area; a convenient way of numbering blocks offered for sale.

Transmission lines - Pipelines that move oil and/or gas after final MMS metering, processing, and/or sale.

Trap - A geologic feature that permits the accumulation and prevents the escape of accumulated fluids (hydrocarbons) from the reservoir.

Treatment facility - A facility that separates hydrocarbons from water, emulsions, and other impurities.

Truncated - Terminated abruptly as if cut or broken off.

Turbidite - Sediments deposited by a turbidity current.

Unconformity - A chronologic gap in the rock record caused by the removal of surficial strata prior to the deposition of any additional material; it is generally caused by a period of structural uplift and erosion.

Undiscovered resources - Quantities of oil and gas estimated to exist outside known fields.

Unit - Administrative consolidation of OCS leases held by two or more companies but explored, developed, and/or produced

by one operator for purposes of conservation, eliminating duplication of operations, and/or maximizing resources recovered.

Unitization - A process by which two or more lease holders allow one company to serve as the operator for exploration, development, and/or production of the affected leases.

Very large crude carrier (VLCC) - A crude oil tanker of 160,000 deadweight tons or larger, capable of carrying one million barrels (158,900 m3) or more.

Workover - Operations on a producing well to restore or increase production. Tubing is pulled and the casing at the bottom of the well is pumped or washed free of sand that may have accumulated.

Well stream - Continuous flow of oil from a well.

PLATES FOR THE GULF OF MEXICO SUMMARY REPORT 3

Plates accompanying this summary report are found in the pocket opposite.

The base map for all of the plates in this series is modified from a New Orleans BLM OCS Office base map entitled "State of Tex., La., Miss., Ala., and Fla., Outer Continental Shelf" (revised 8/81, scale 1:100,000).

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Gulf of Mexico Summary Report 3

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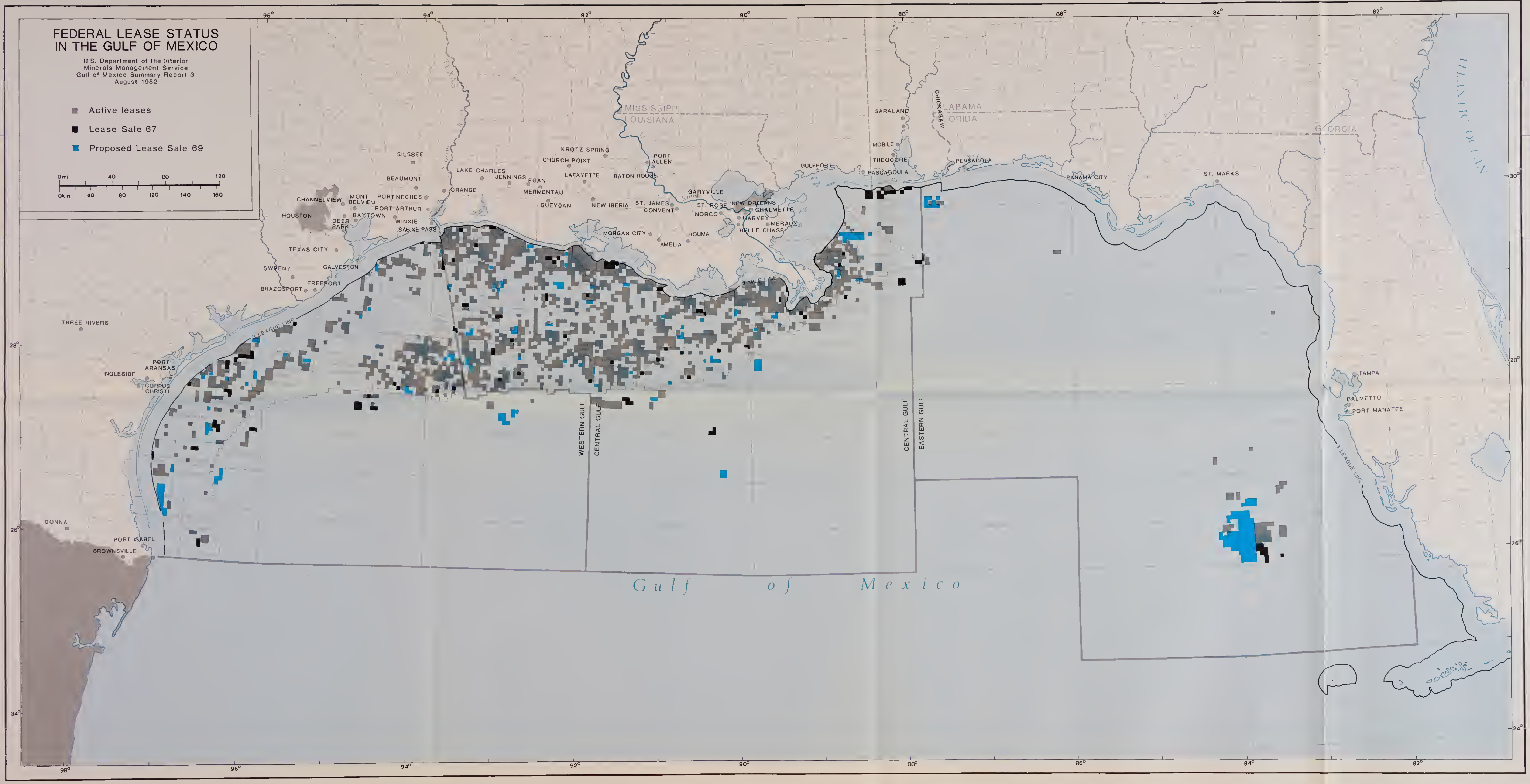

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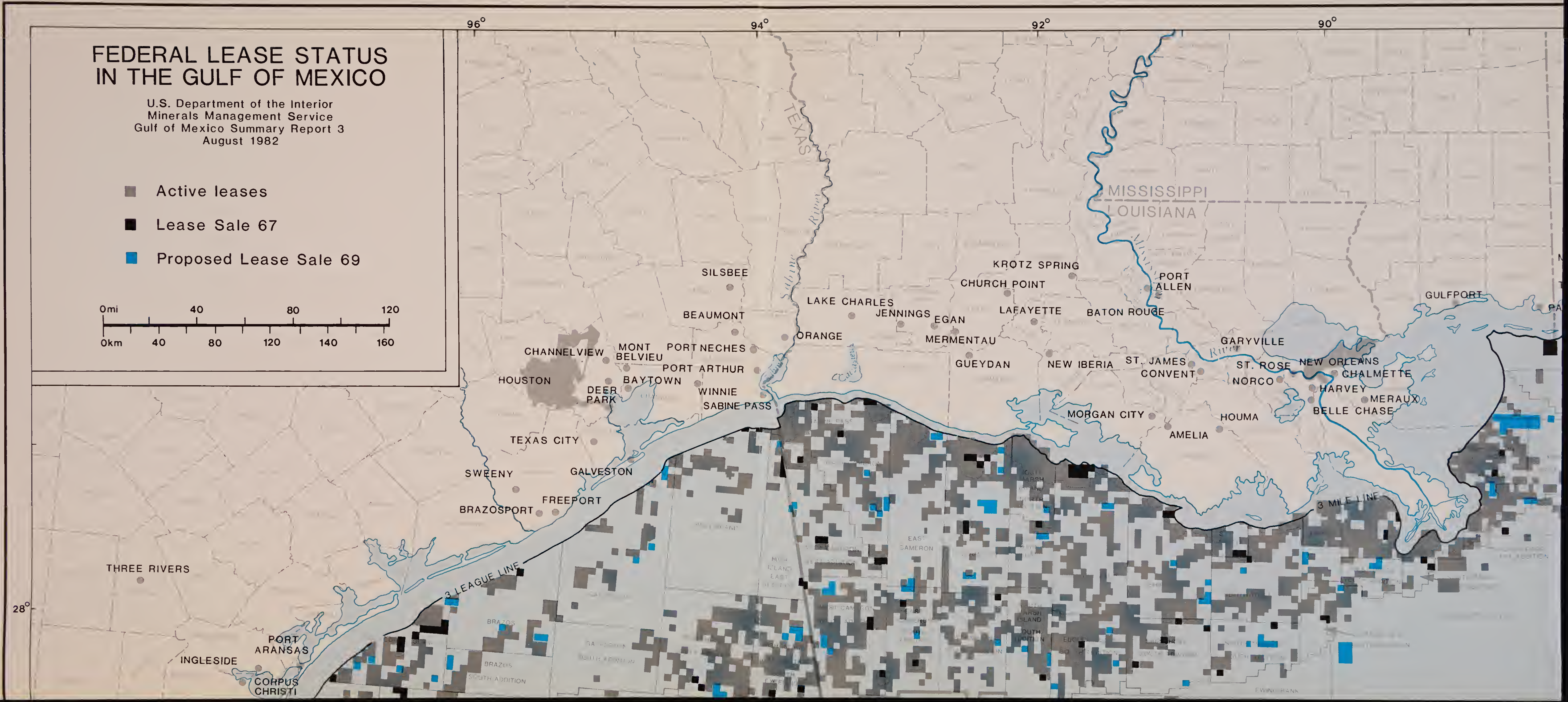
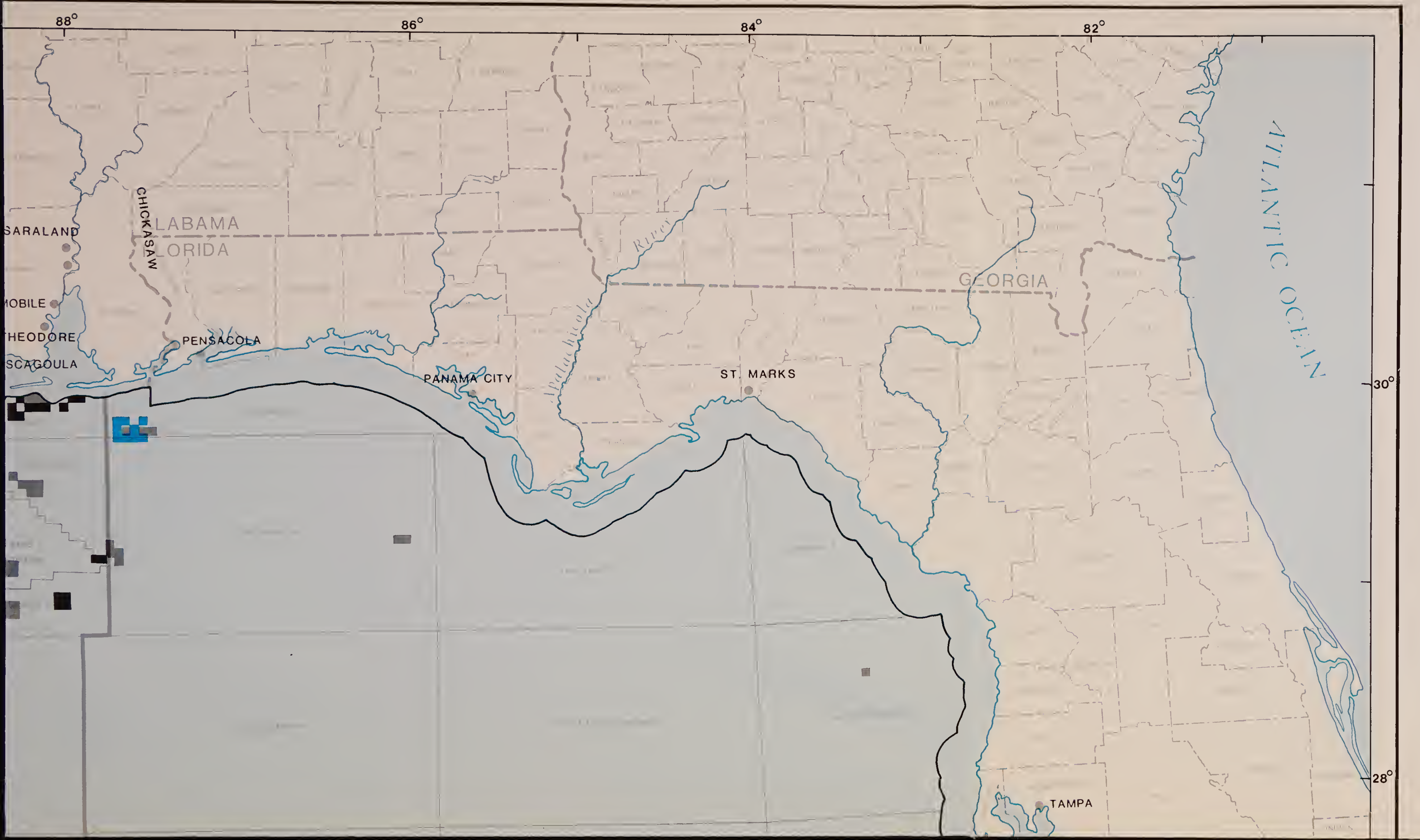


FEDERAL LEASE STATUS
IN THE GULF OF MEXICO
U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico Summary Report 3
August 1982
Active leases
Lease Sale 67
Proposed Lease Sale 69
0mi 40 80 120
0km 40 80 120 140 160
96°
94°
92°
90°
28°
TEXAS
Sabine River
MISSISSIPPI
LOUISIANA
SILSBEE
BEAUMONT
LAKE CHARLES
JENNINGS
EGAN
KROTZ SPRING
CHURCH POINT
LAFAYETTE
BATON ROUGE
PORT ALLEN
GULFPORT
ORANGE
MERMENTAU
CHANNELVIEW
MONT BELVIEU
PORT NECHES
PORT ARTHUR
HOUSTON
BAYTOWN
DEER PARK
WINNIE
SABINE PASS
GUEYDAN
NEW IBERIA
ST. JAMES
CONVENT
GARYVILLE
ST. ROSE
NORCO
NEW ORLEANS
CHALMETTE
HARVEY
MERAUX
BELLE CHASE
MORGAN CITY
AMELIA
HOUMA
TEXAS CITY
SWEENY
GALVESTON
FREEPORT
BRAZOSPORT
3 MILE LINE
3 LEAGUE LINE
THREE RIVERS
PORT ARANSAS
INGLESIDE
CORPUS CHRISTI
EAST CAMERON



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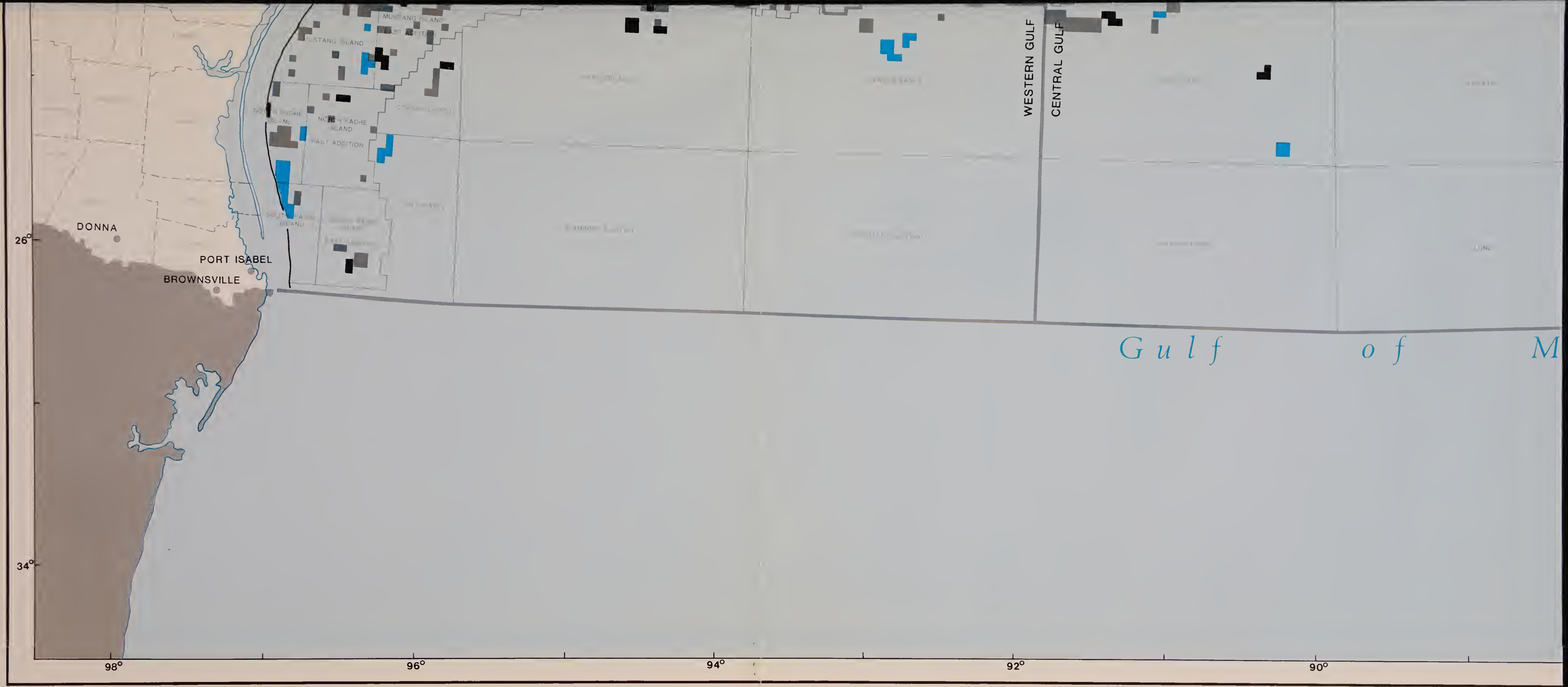

MUSTANG ISLAND
MUSTANG ISLAND
WESTERN GULF
CENTRAL GULF
NORTH PADRE ISLAND
NORTH PADRE ISLAND
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PORT ISABEL
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Gulf of M
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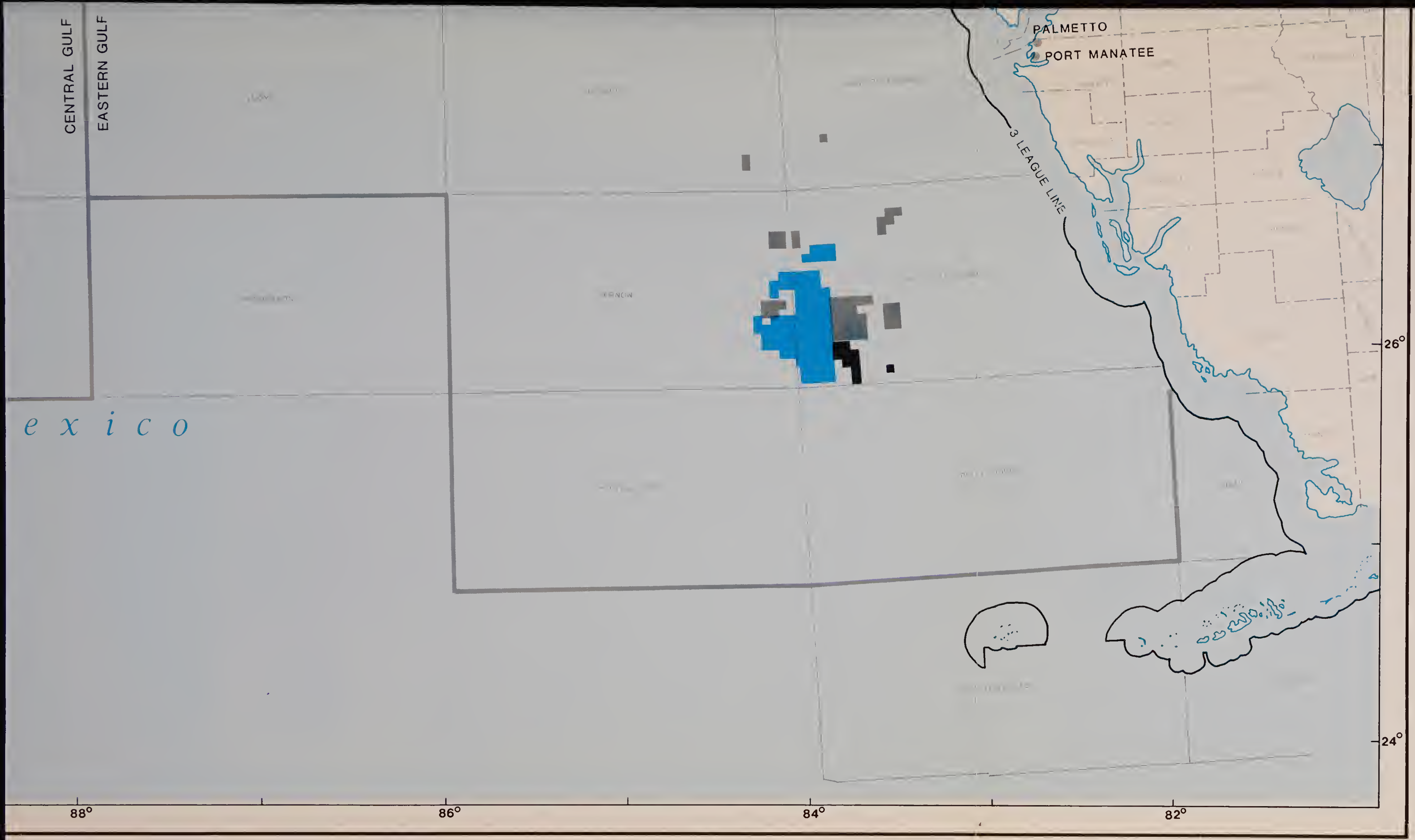
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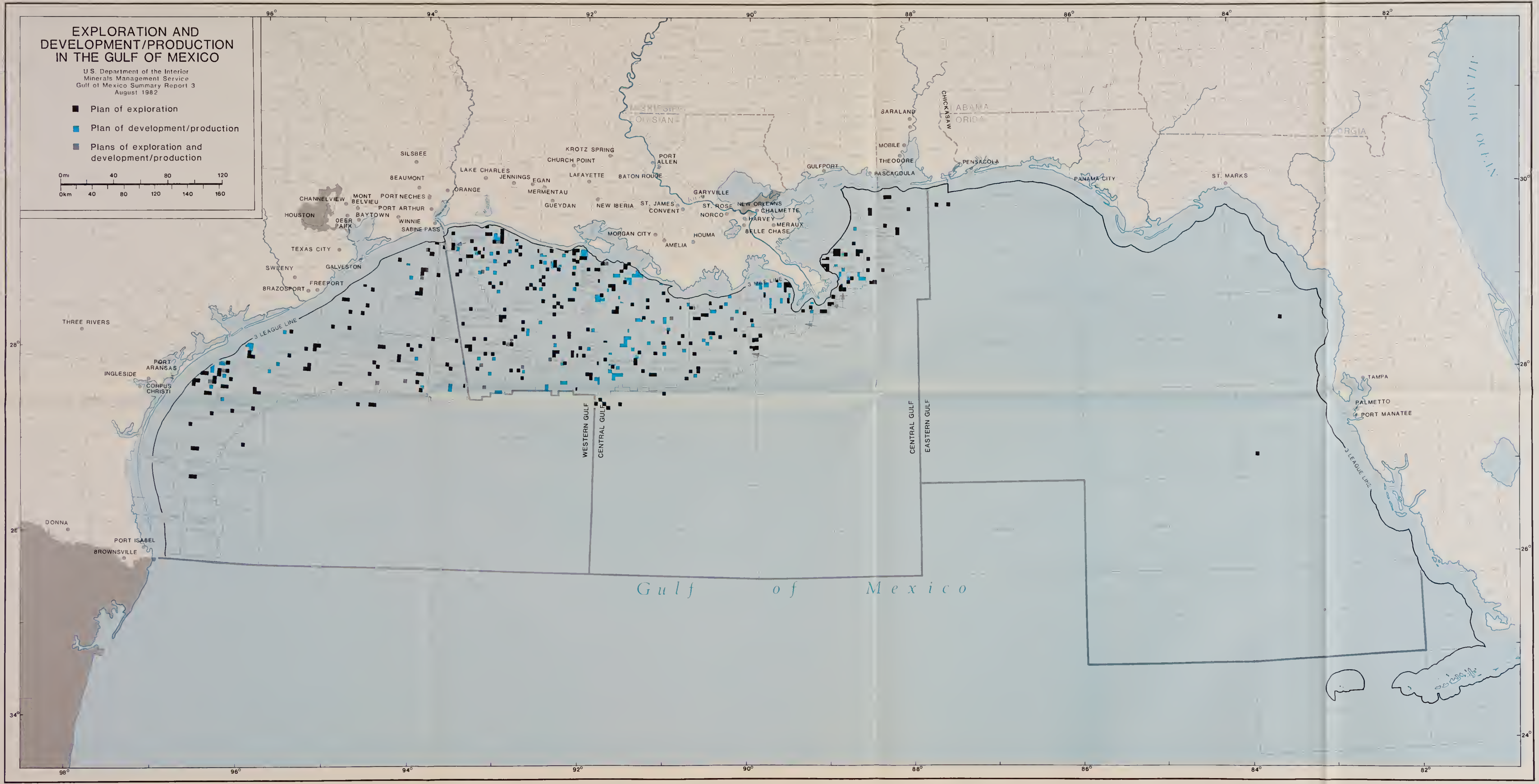

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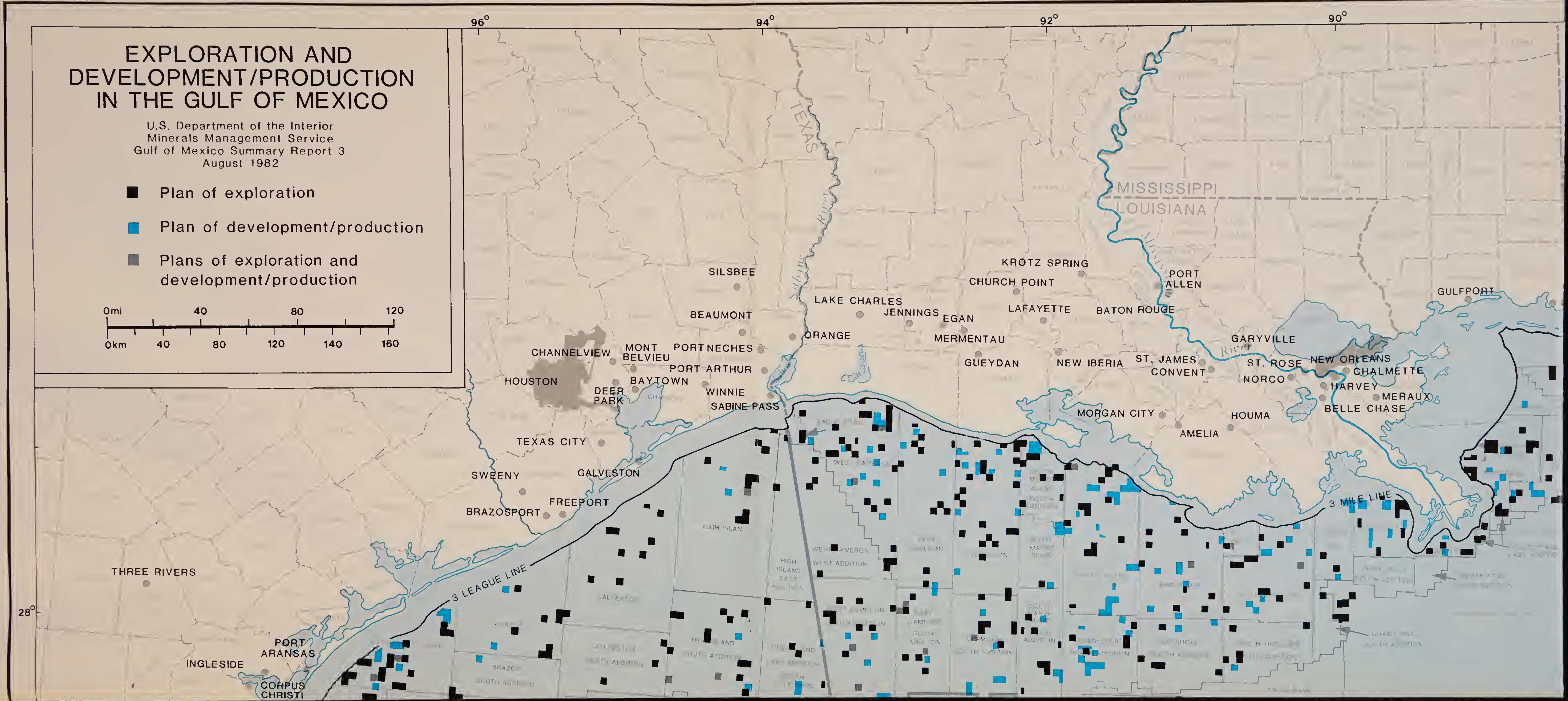
EXPLORATION AND DEVELOPMENT/PRODUCTION IN THE GULF OF MEXICO
U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico Summary Report 3
August 1982
Plan of exploration
Plan of development/production
Plans of exploration and development/production
0mi 40 80 120
0km 40 80 120 140 160
96°
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TEXAS
Sabine River
MISSISSIPPI
LOUISIANA
River
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3 LEAGUE LINE
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WEST CAMERON
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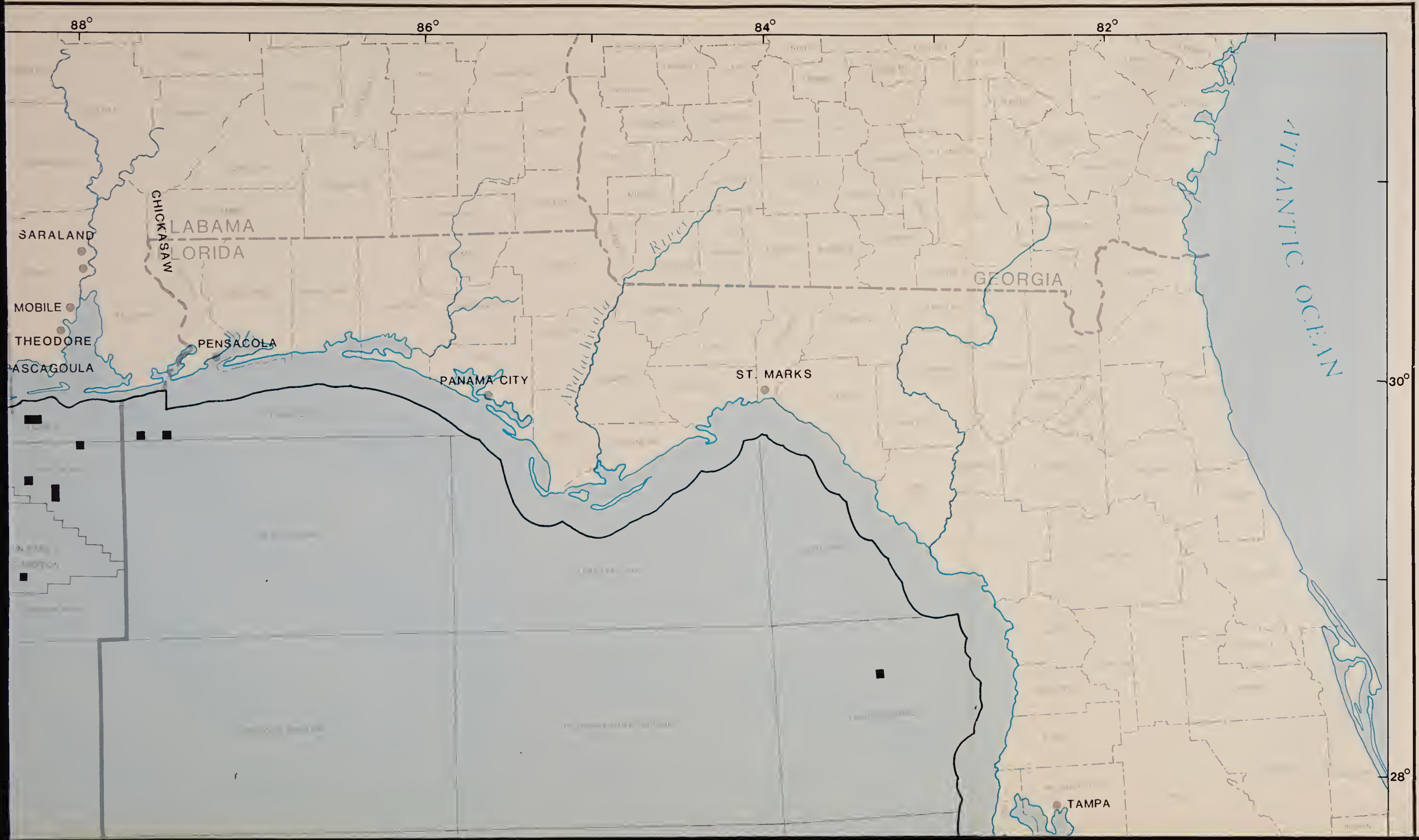
BRAZOS SOUTH ADDITION



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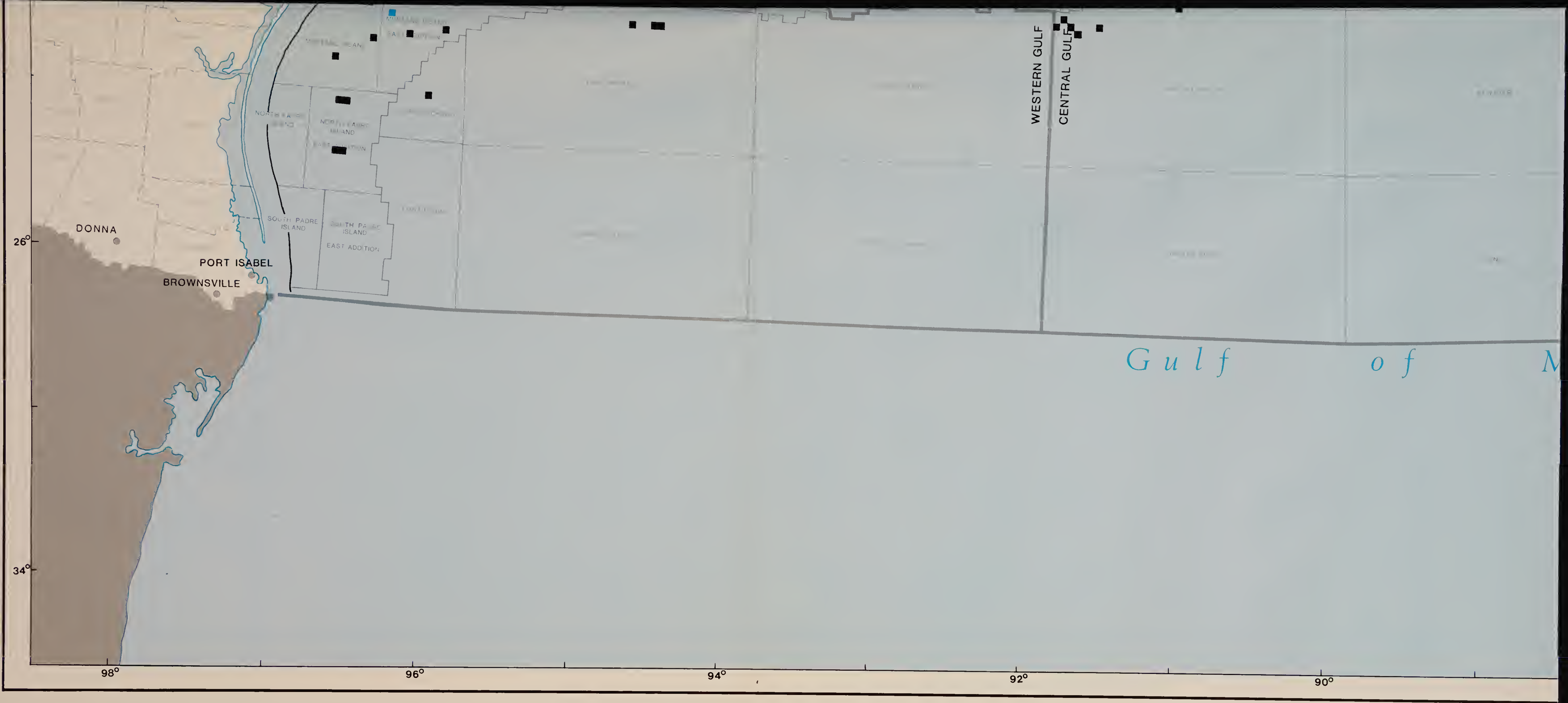
DONNA
PORT ISABEL
BROWNSVILLE
SOUTH PADRE ISLAND
SOUTH PADRE ISLAND
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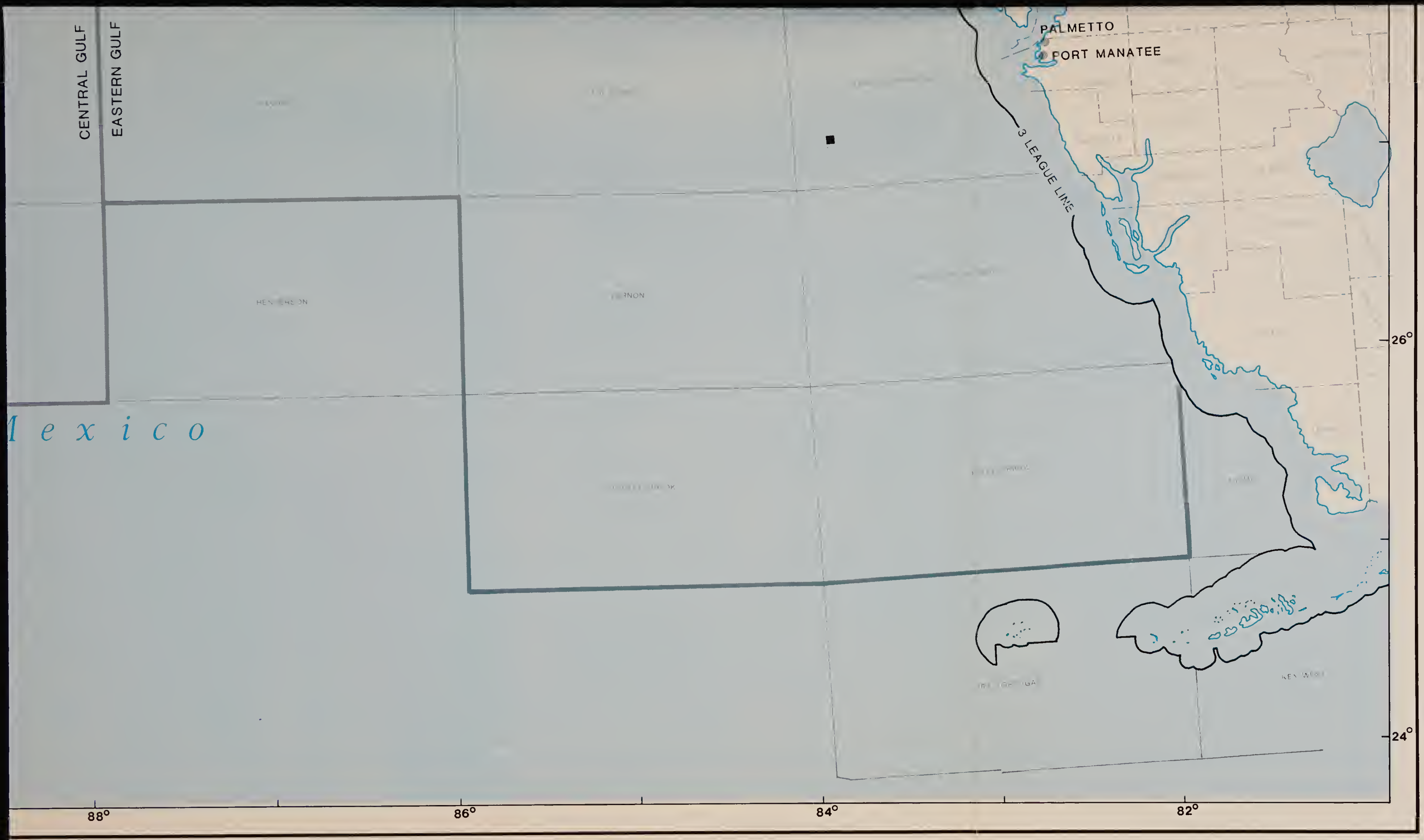
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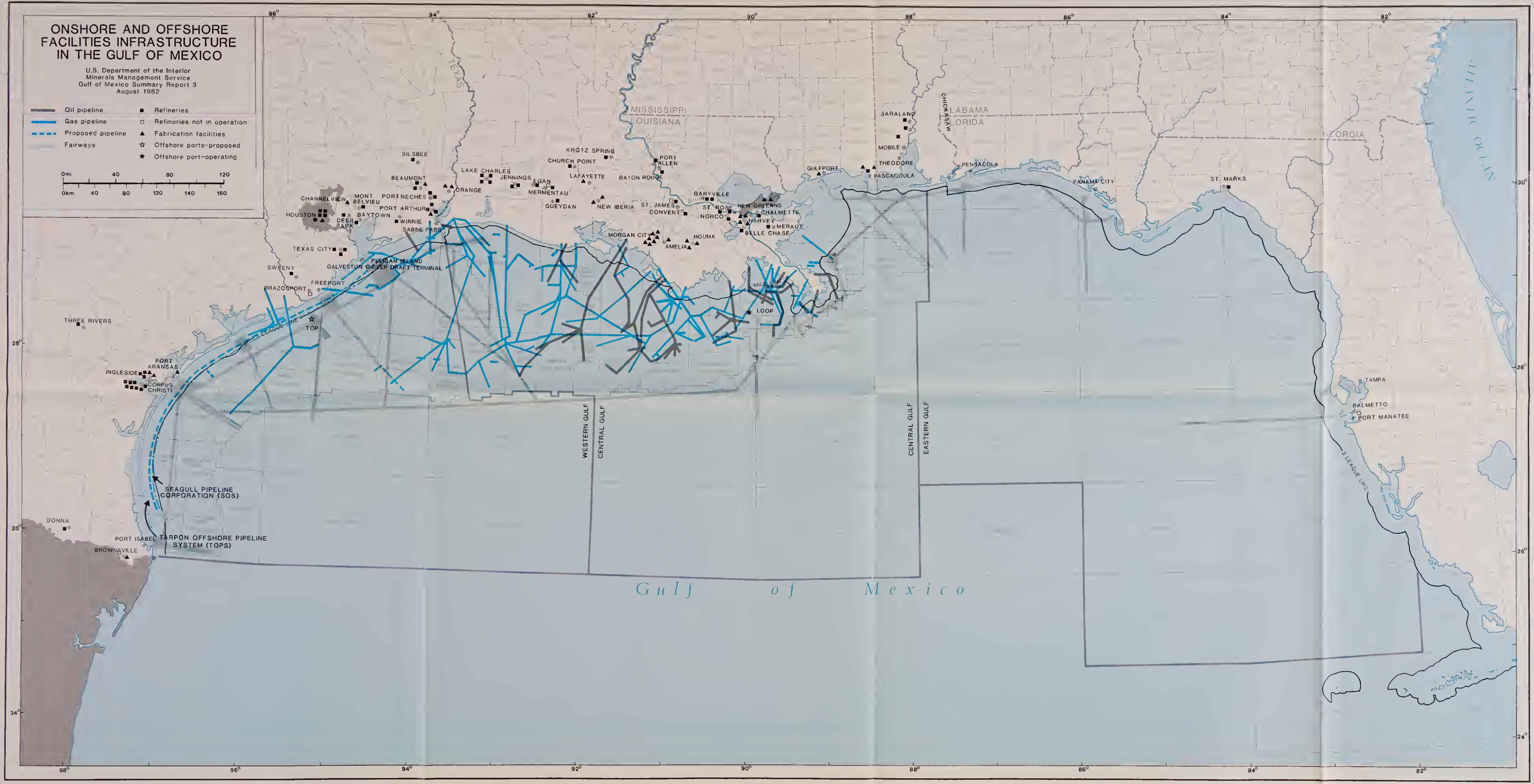

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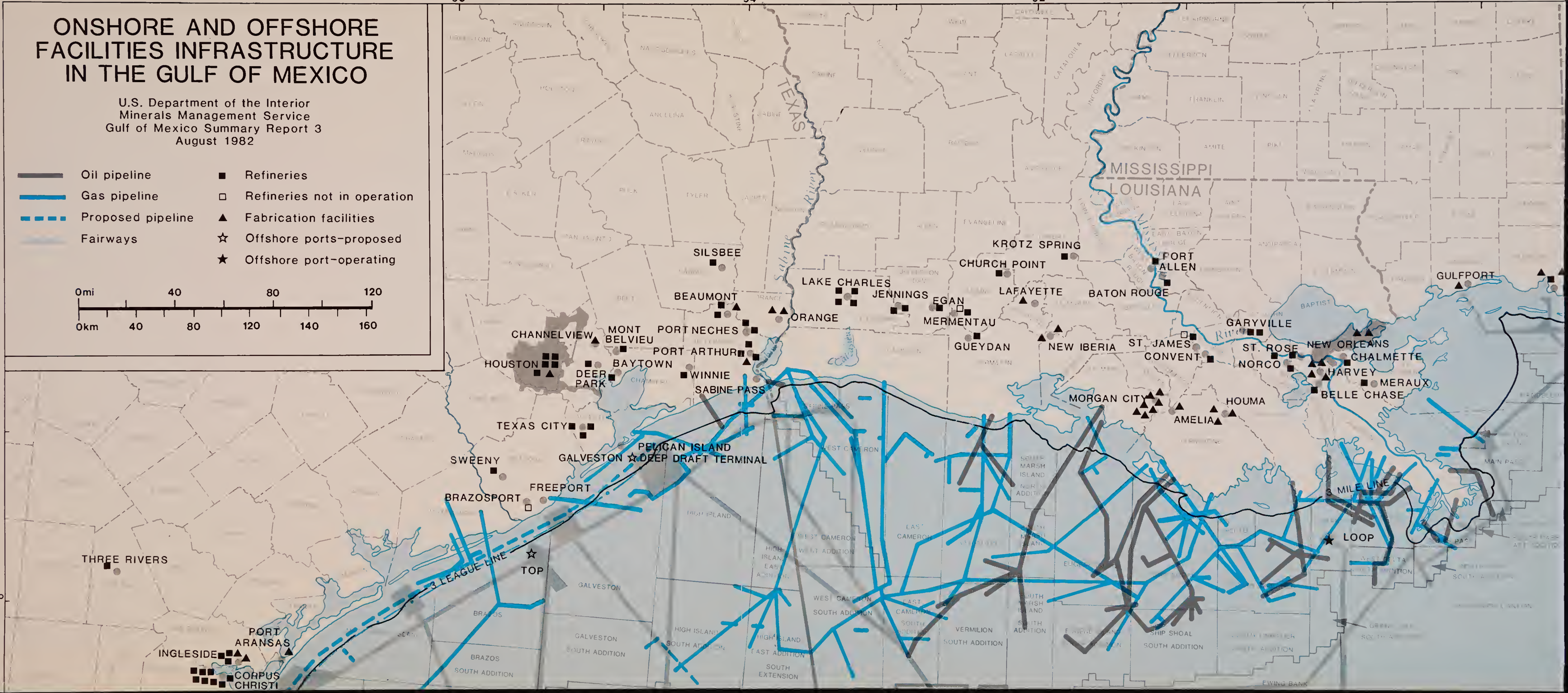
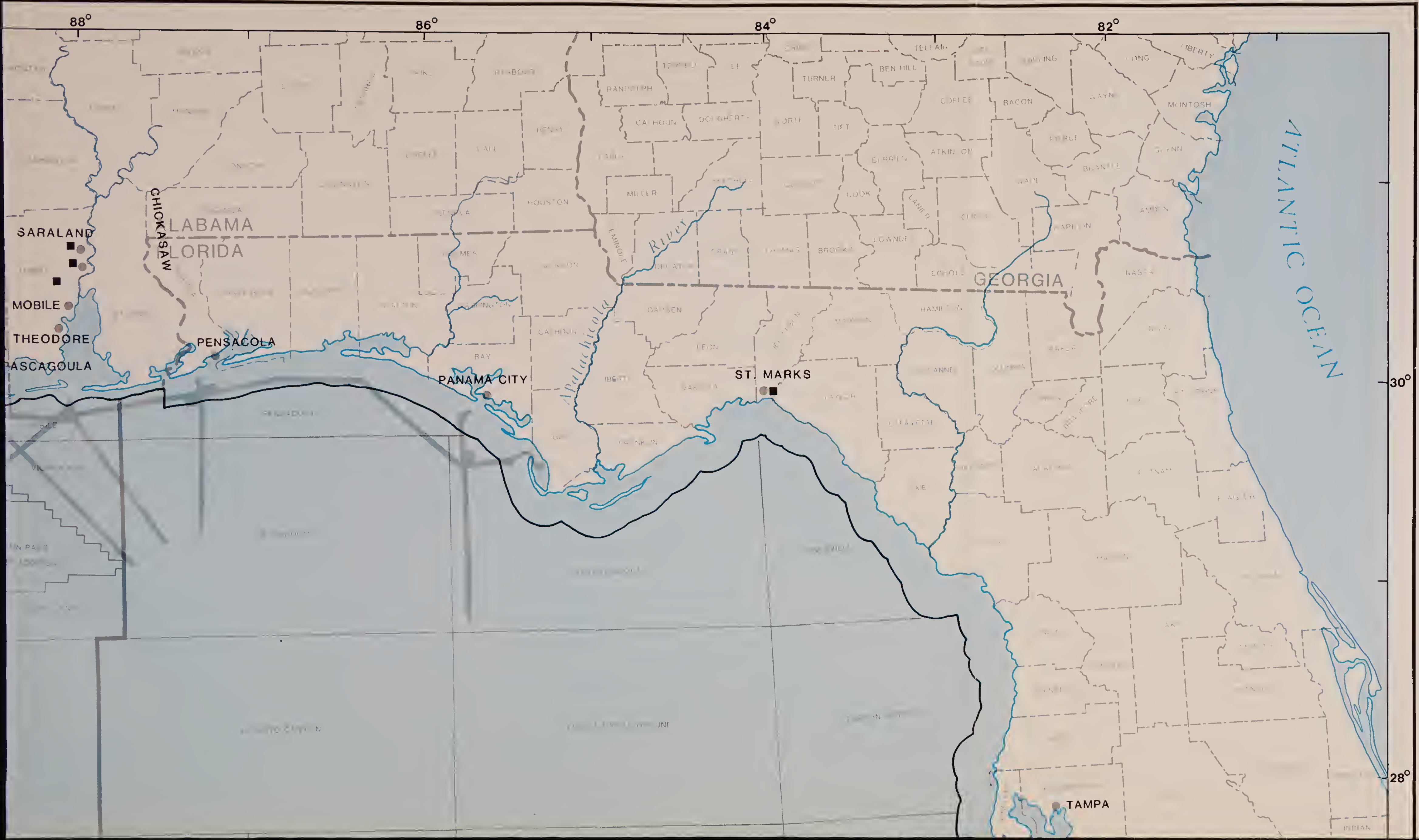
ONSHORE AND OFFSHORE FACILITIES INFRASTRUCTURE IN THE GULF OF MEXICO

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico Summary Report 3
August 1982





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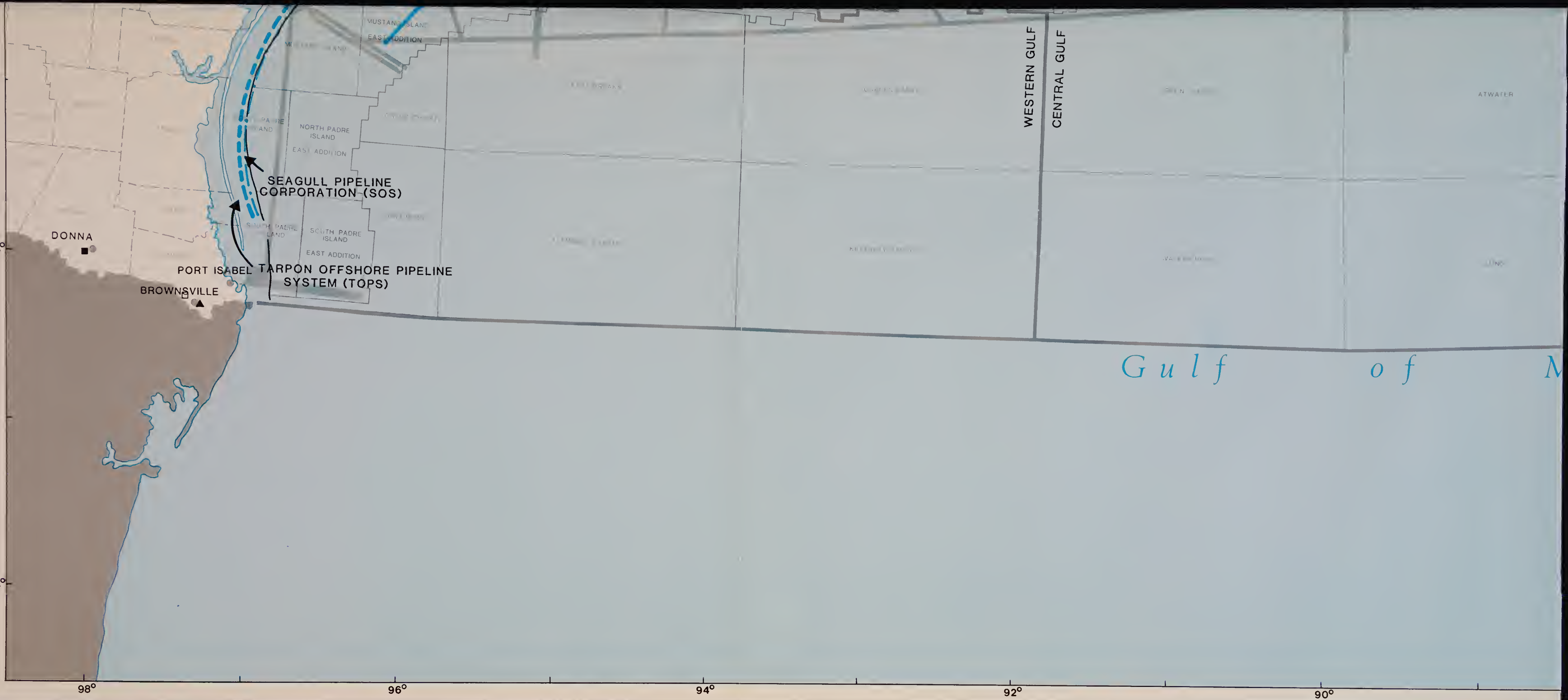

MUSTANG ISLAND
EAST ADDITION
WESTERN GULF
CENTRAL GULF
ATWATER
NORTH PADRE
ISLAND
EAST ADDITION
SEAGULL PIPELINE
CORPORATION (SOS)
DONNA
SOUTH PADRE
ISLAND
EAST ADDITION
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PORT ISABEL
TARPON OFFSHORE PIPELINE
SYSTEM (TOPS)
BROWNSVILLE
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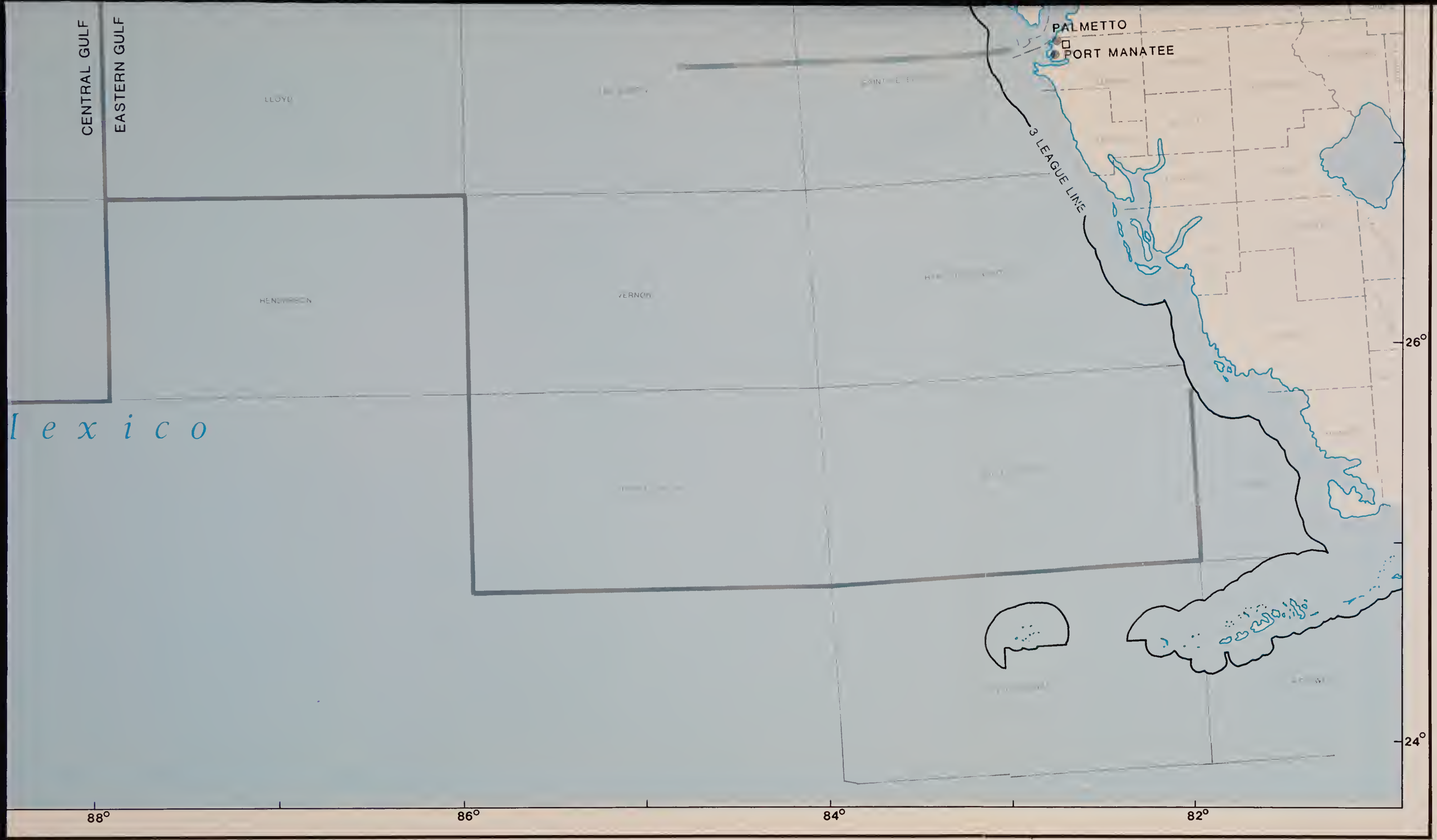
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